JANUARY 29, 1938

ELECTRICAL WORLD

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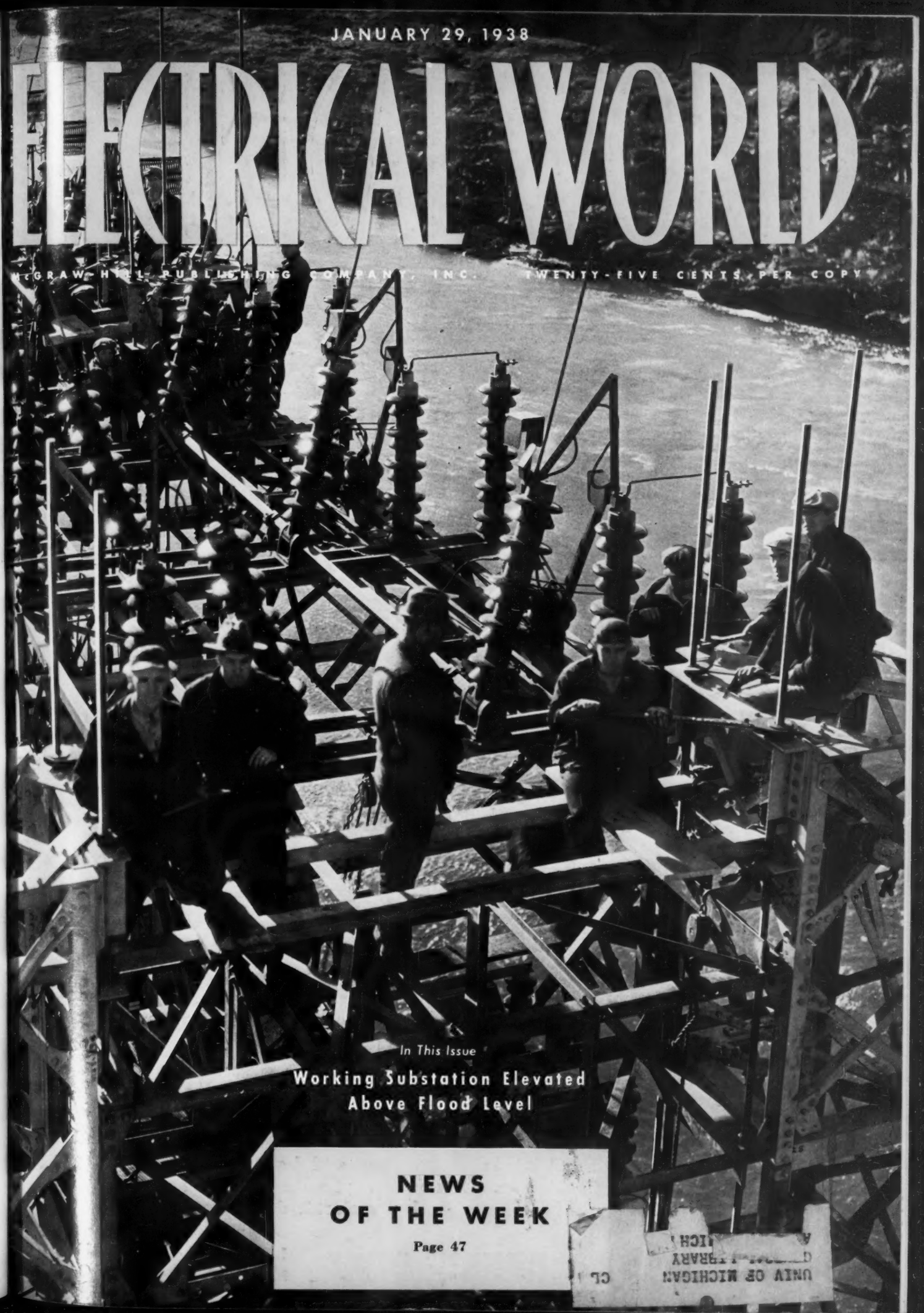

In This Issue

Working Substation Elevated Above Flood Level

NEWS OF THE WEEK

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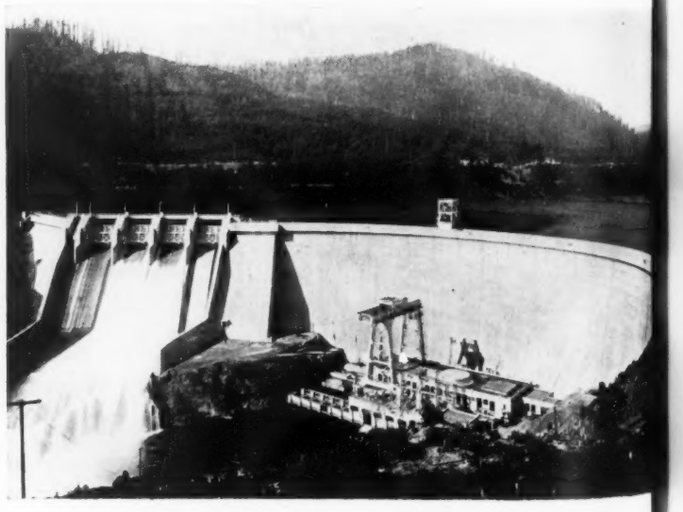
UNIV OF MICHIGAN

Above: Murray Duct Rubber Forms After Completion of a Sectional Fill.

THERMAL STRESSES

IN CONCRETE STRUCTURES

CONTROLLED BY MURRAY DUCT



To prevent thermal stresses within a concrete structure calls for the utilization of some method of cooling.

The use of Murray Duct is a highly satisfactory and economical way of cooling massive concrete structures—particularly dams.

Murray Duct affords unencumbered egress for the heat to dissipate and emerge—air-cooling. The matrices—rubber forms—are set-up in the concrete before the pour and withdrawn 12 hours after the initial set.

Throughout the entire unobstructed duct length, air circulation is provided—or artificial cooling may be applied.

The advantages of Murray Duct over other methods using permanent forms—piping for instance—are manifold, for

Heat is dissipated at a far greater rate.
Installation costs less (forms can be used over and over again).
Maintenance is eliminated entirely.

Write for details of the Murray conduit system and have the facts before you when planning new or reconstructed hydro electric developments.

METROPOLITAN DEVICE CORP. 1250 ATLANTIC AVENUE BROOKLYN, NEW YORK

ELECTRICAL WORLD

JANUARY 29, 1938

What Are the Terms of Peace?

"In every case where a customer of the complainants has been lost to the Authority, the cause has been not unlawful competition, but the lawful allurement of substantially lower prices."

"The complainants have no immunity from lawful competition, even if their business be curtailed or destroyed."

Thus did the three-judge federal court at Chattanooga in the eighteen utilities case against TVA give legal authority to the "yardstick" and thereby uphold the right of the government through competition to destroy private business.

While final decision rests with the Supreme Court, to which it has been reported appeal will be taken, it is obvious, when one considers also the Supreme Court decision of two weeks previous in the PWA municipal loan and grant case, that there is nothing now to prevent government from making a grant of the entire cost of a municipal project or from giving power away. The court did not inquire into the fairness of the TVA rate—in fact, the rate was not permitted to be a point at issue.

While these two decisions have been very definite blows to the utility industry, they are by no means fatal. By their very breadth they impose a new obligation upon the Administration and upon Congress. When Washington was fighting against the alleged "power trust" it was striking at what it claimed to be financial control in the hands of a small number of people. Now, by these decisions, the investments of hundreds of thousands of people rest in the hands of the Administration.

The Administration has stated at different times that it has no quarrel with operating utility companies nor any desire to put them out of business. Nevertheless, unless Congress rises to its responsibility, what is there to prevent their destruction through an unwise power policy?

There have been numerous conferences between utility representatives and the President and nothing tangible yet has resulted. If he has been awaiting the outcome of these court cases, perhaps he will now make his plans known. Certainly the utilities are not going to find it easy to borrow for construction, either in the form of bonds or stock, so long as uncertainty exists.

If the Administration and Congress are sincere in attempting to find a way to restore business confidence, and if business men and economists who have told the President recently that public utility spending is the keylog of the jam are right, then those in authority at Washington have a moral obligation to reassure investors on the following questions:

What will be the government's policy with respect to duplication of plant and facilities?

What will be the policy of the government with respect to loans and grants to cities for municipal ownership of utility services?

What policy will the government follow with regard to power in connection with flood control or regional development?

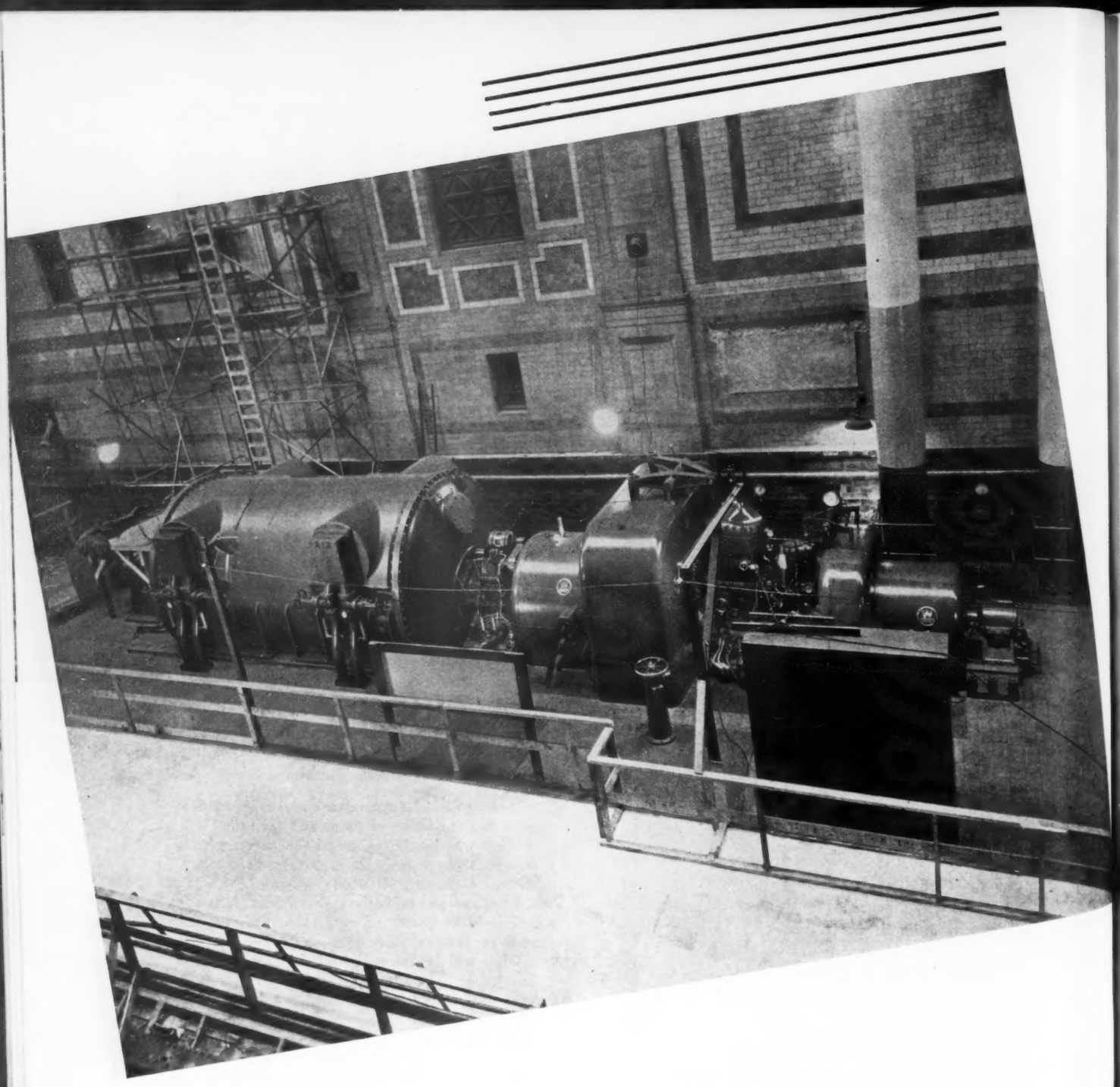
What will be the policy of the government in marketing power from present or future federal projects?

If the policy of the government is to be one of marketing through federal agencies, instead of through existing utility systems, will it be at a price arbitrarily fixed below that of utilities in the area or one that reflects the true costs of the development as may be properly applied to power?

If this activity of the Administration has been to secure lower rates, how low should rates be? What return would be fair?

What kind of guarantees is the government going to be willing to give for performance in accordance with a mutually acceptable program?

The President and Congress have the power now entirely in their hands. By their actions they can destroy present investment and the savings of taxpayers, or, they can give the reassurance that will bring utility spending and re-employment. There has been almost constant legal fighting between the government and the industry for years. The government has won the legal decision. Now what will be its terms of peace?



TOPPING TURBINE AT WATERSIDE

High spot of the inspection trips taken this week by engineers attending the winter convention of American Institute of Electrical Engineers in New York City was the tour which took them to see this 53,000-kw., 1,200-lb. and 900-deg. F. topping turbine, installed recently as part of the modernization of Waterside generating station of Consolidated Edison Company of New York, Inc.

Small Customer Demand Metering Improved

Cumulative register introduced and reading technique perfected to assure accuracy and satisfaction of customers with small commercial demands

By WALTER C. WAGNER

General Superintendent Meter Division, Philadelphia Electric Company

DEVELOPMENTS in connection with demand metering and reading have been brought to a point in the Philadelphia Electric Company where it may be said that the following commonly experienced difficulties have been very largely, if not entirely, overcome:

1. Loss of a record of customer's demand, due to the physical resetting of the sweephand pointer by the reader at the time of reading the demand.
2. Errors in reading simple demand scales by the meter reader.
3. Errors in reading due to the complexities of scales existing on the demand registers, the inability of readers to evaluate the readings.
4. The difficulty of educating customers to read by means of such meter readers.
5. Errors in reading by the reader due to parallax.
6. Careless resetting or neglect to reset the sweephand by the reader.
7. Incentive for the customer to tamper by pushing the sweephand back to a lower position.

Failure of the reader to reset the sweephand back to zero, due to carelessness, or to reset the sweephand at all, gave rise to serious complaints. In the former case it could be shown that this did not result in high demands, for the pointer pusher movement determines the maximum sweephand pointer position for the ensuing billing period. Failure to reset the pointer at all, however, could not be checked in any way. Seal identification of the reader, even if a seal were changed by him, would not serve as a check on this.

The incentive to lower one's bill, by influencing the reader, is practically always barren of results. The temptation to push back the slender pointer, however, remained. Should a reader's seal have been missing, or entrance otherwise gained, there often existed no evidence of such tampering. Any device may be tampered with, so that the best answer is to make it as difficult as practicable, both with respect to entrance and by the design of the device.

As a means of minimizing causes of complaints from customers that demand readings were erroneous, some companies have at times made use of special cameras (using flashlight bulbs) to obtain monthly photographic records of sweephand positions.

New reading sheets devised

Demand scales have assumed many prevailing forms and values per division. Consequently, division values vary widely, and it is not strange that experience has shown that readers may make errors in the evaluation of pointer positions. This difficulty was largely overcome by the use of sheets (see Fig. 1) on which the reader indicated the *number of divisions passed over.* The billing office force, equipped with diagrams of scales corresponding to each of the registers concerned, made necessary numerical demand reading entries for billing purposes. Relationship of such diagrams to demand scales is shown in Fig. 2. Perhaps of equal importance was the inability of the reader to teach the customer how to read the scale of his demand meter, leaving this part of billing a mystery to him.

When the scale divisions are close together and a reading was taken at other than directly in front of the dial, the error due to effects of parallax also gave rise to customer questions. Basing the reading upon a cyclometer indication or a set of dials, rather than upon the single sweephand pointer position, eliminates this possible source of error.

Cumulative register proposed

A basic approach to the problem was instituted as far back as 1931, when an executive request was received to eliminate, as far as was economically practicable, the conditions resulting in the unsatisfactory operating characteristics of the then standard sweephand demand register installed on a watt-hour meter and mounted within a common inclosure.

As a result there followed the development of the cumulative demand register. The writer had found, after intensive analysis, that no then existing type of demand metering equipment would prevent the enumerated difficulties without incurring an excessive increase in first cost and operating expense. Even then the available designs would not permit of a demand register that could be incorporated with its watt-hour meter in a common cover inclosure.

Manufacture of a device based

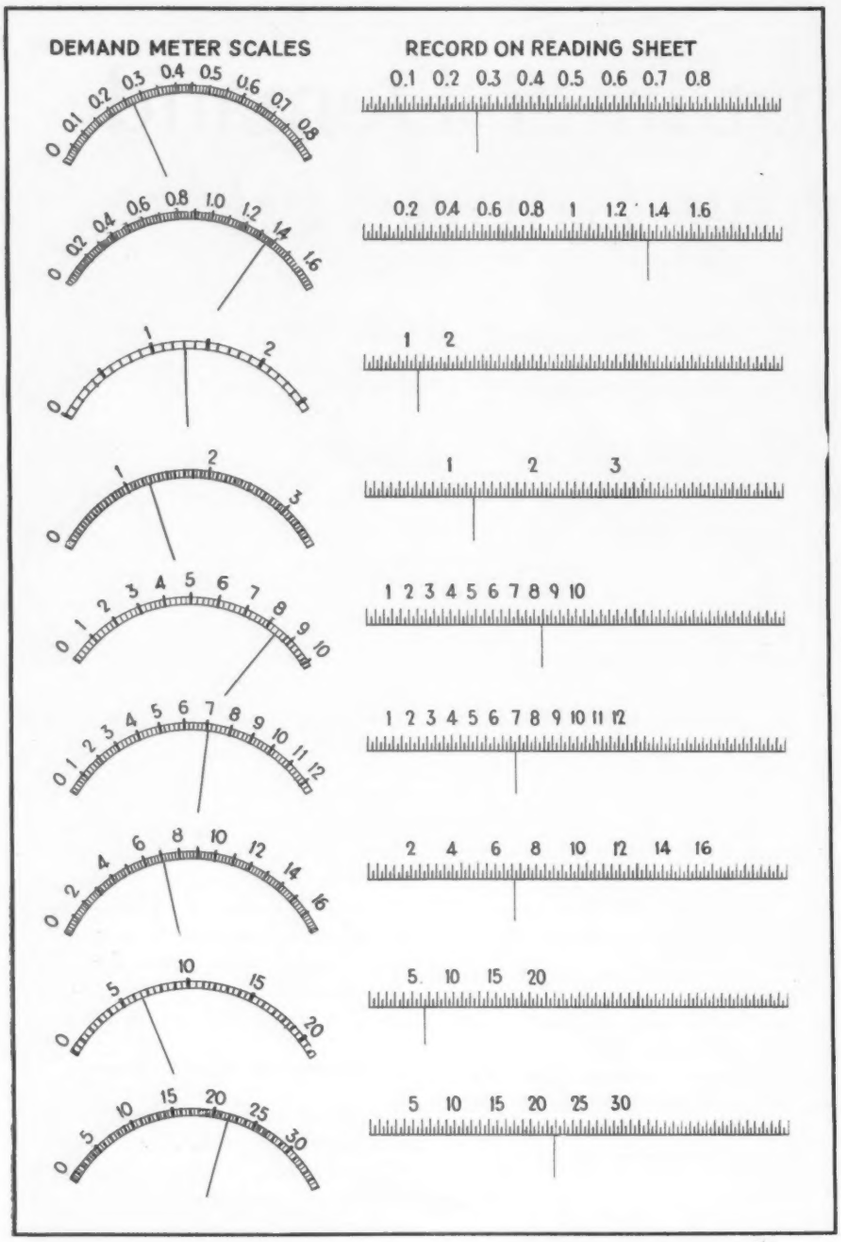
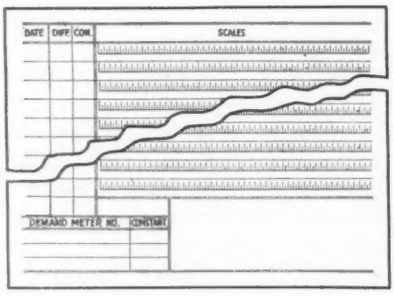


Fig. 1—Reader records divisions passed over

(a) Demand reading sheet has uniform scale to which reader converts the variegated readings (b) encountered on equally variegated dials.

upon a principle of operation not theretofore employed in demand meter manufacture was, therefore, proposed. Manufacturers' representatives late in 1931 were called together in conference by the author to review the deficiencies outlined above and the proposal was made to them that this new type of *cumulative demand* meter be created simultaneously by manufacturers.*

* It was afterward determined that a patent issued to Dr. Karapetoff some twenty years before precluded patenting this modern application.



The principle proposed to them involved the simple addition to the then standard sweephand demand register of a set of independent dials geared to the sweephand demand pointer shaft in such manner that resetting the pointer to zero (at the time of the meter reading) would advance a set of independent dials. Such dials would thereby record the amount of movement of the sweephand pointer from its position at maximum demand to its zero position. These independent dials (in either cyclometer or dial form) would accurately record *the addition* of the demand of that reading, to the *sum* of the previous demand readings. This record would remain on the independent dials until the next meter reading date, when the resetting of the pointer would add the next demand, cumulatively, to the dials.

Actual selection of the cyclometer type of recorder in preference to the customary watt-hour form of dial followed the added executive request to remove all possible elements of customer's mystery or difficulty in reading meters. Some advantage is thought to exist in another form of dials for demand registration, to assist readers and customers in differentiating between the kilowatt-hours of energy and the kilowatts of demand readings.

In order to avoid an added physical burden to the watt-hour meter, one requirement was that these dials *should not be moved by the meter,* but by a hand-operated sweephand reset. (Later manufacturers developed a motor-driven reset.) One other important element of design was *that the demand dials* should *have the same multiplying constant as that of the kilowatt-hour dials.*

Another very necessary requirement was that the hand-operated device operated from outside the meter cover to return the demand setting to zero at the time of reading *must be ratcheted* to permit rotation of the sweephand *only in a resetting direction* and the reset device sealed in a fixed position to make certain that no operation, inadvertent or otherwise, would record a greater or a less value than the accurate demand. For example, while the meter reader is compelled to make a reset, *as the cumulative reading must change at the time of reading,* the sweephand could otherwise be pushed *only part way back to zero,* giving a *less demand addition,* or, by a *reverse rotation* of the hand-driven control, the sweephand could be *pushed to a higher value* than actually metered, and then pushed back to zero, thus add-

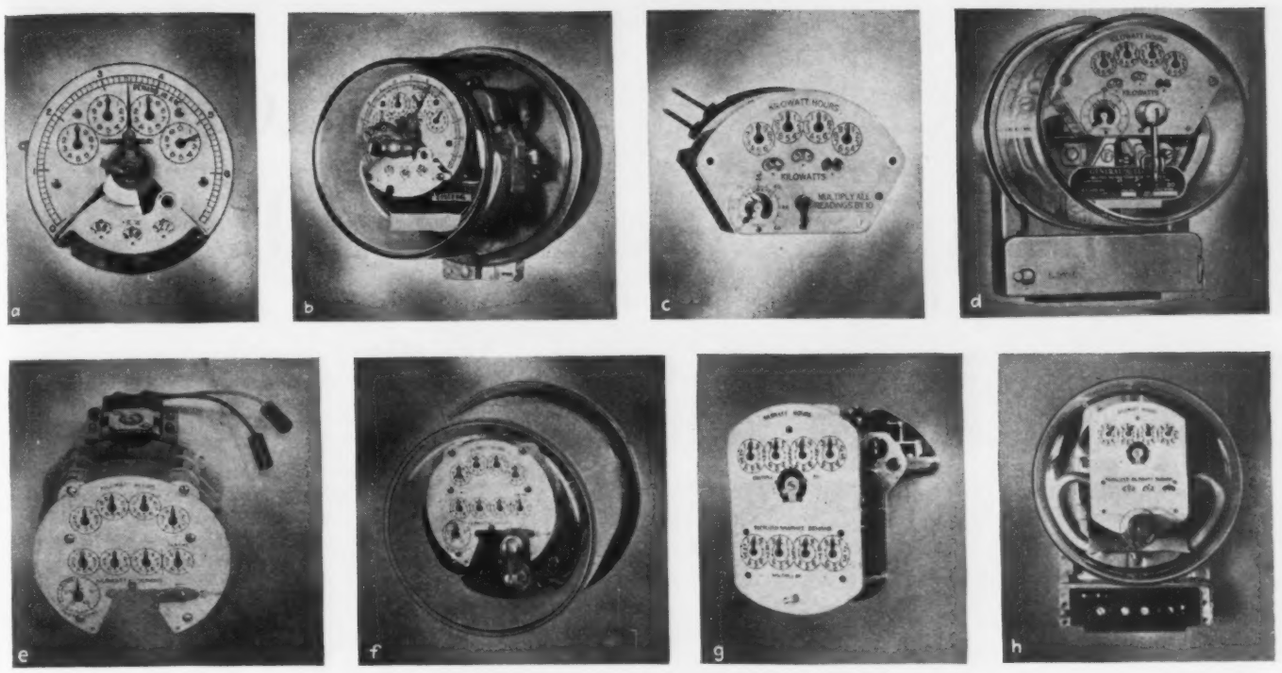


Fig. 2—All meter manufacturers offer demand dials and/or composite watt-hour-demand with cumulative demand registers

(a) Duncan Type T-2 cumulative demand register.
(b) Duncan Type MFS watt-hour meter equipped with cumulative demand register Type T-2.
(c) General Electric Type M-21 cumulative demand register.
(d) General Electric Type I-20A watt-hour meter equipped with cumulative demand register Type M-21.
(e) Sangamo Type HGC cumulative demand register.
(f) Sangamo Type HFS watt-hour meter equipped with cumulative demand register Type HGC.
(g) Westinghouse Type RW-2 cumulative demand register.
(h) Westinghouse Type CA watt-hour meter equipped with cumulative demand register Type RW-2.

ing a higher demand than actually used by the customer.

By a ratcheted arrangement one not only makes certain of the proper registration but provides a positive deterrent against a type of tampering by the customer who could break a seal and move the demand pointer backward; any such action on his part would serve to *increase* the cumulative dial registration between meter reading dates and thereby show such tampering evidence at the time of the next regular reading. Bending the sweephand pointer is of no avail, for the cumulative *dials are geared to the pointer support.*

Greater accuracy of demand registration and reading is attained in several ways: First, as the pointer scale is not used for billing, but only the differences between independent demand dial readings are read before and after reset at the time of reading, there is no parallax error. The great confusion and, at times, errors in reading the many sweephand pointer scales (some 65 or more different combinations) by readers are entirely eliminated, as the same constant applies to the demand dials as to the kilowatt-hour dials on the register, and no sweephand dial scales are to be interpreted. Further, the degree of reading accuracy is greatly improved with the greater precision of the group of three or more dials. Errors will be made at times, even in reading dials, but, in the case of cumulative kilowatt-hour dial readings, if a question exists, these errors can be caught by reading the dials again. In the case of cumulative demand dials *no demand dial movement occurs between readings, so that a positive and accurate check is available until the next reading date.*

Other physical objectives attained

From a mechanical viewpoint, several factors had to be given consideration. For example, the speed of rotation of the fastest cumulative dial could possibly be so great that if operated by the then existing sweephand reset devices inertia would cause the dial to over-run and record a greater than actual demand. Again, the arrangement must permit of reading the single numeral, or two, if the reading is between two unit values. The entire assembly of the register should be compact and so designed as to permit a meter tester to make the usual adjustments to a watt-hour and the demand register meter. The added equipment must, if, for example, its driving motor is de-energized due to an open supply circuit to the register motor, result in a *slowing up, rather than a speeding up,* of the meter after such happening.

During the years of development it was inevitable that many difficulties had to be overcome. Meter manufacturers gave this program very active attention and, in addition to their laboratory work and field experience largely gained from the operating companies, satisfactory cumulative demand registers are now on a production basis by meter manufacturers. One may also report the later satisfactory development of a cumulative demand *meter,* requested by the author, consisting of a separate demand instrument operated by contacts from two or more watt-hour meters.

There still exists, however, need for a graphic recording device as a part of the demand register that can show approximately the time

[*Continued on page 92*]

Energized Substation Raised Above Flood Level

Elevation in sections by synchronized ratchet mechanism enabled station to continue in service during operation

By BARTOW VAN NESS, JR.
Pennsylvania Water Power Company, Baltimore

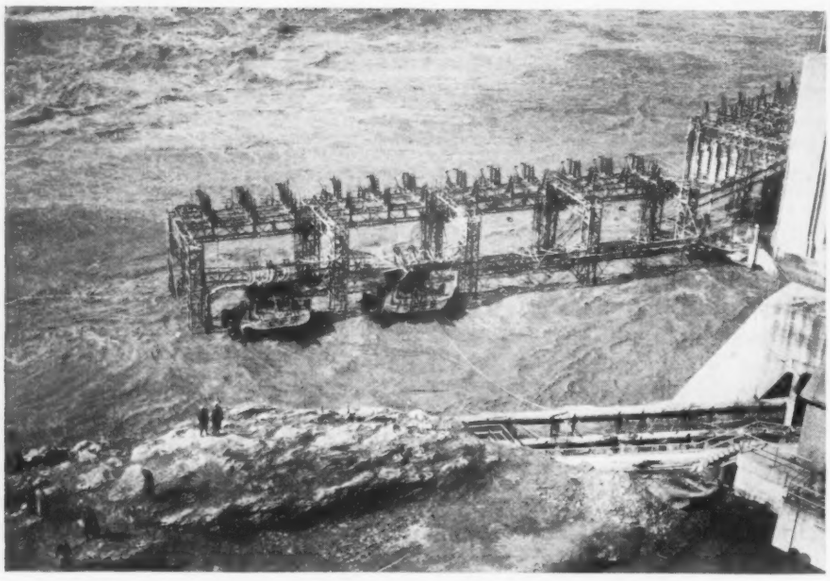


Fig. 1—Transformers awash in 860,000-cu.ft.-per-second flood

Minor deflection wall failed during unprecedented 1936 deluge and flooded the substation. The job detailed in the accompanying article was to guard the equipment against future high water.

Fig. 2—Two 15,000-kva. transformers were overturned by flood

Two 30,000-kva. units tilted off their foundations were held from overturning when their oil conservators caught on the substation steel. Low-voltage transformer bushings, cable potheads and cables were shattered and twisted. Four sets of lightning arresters were completely destroyed. The concrete foundations, high-voltage airbreak switches and steel structures fortunately escaped serious damage.

OF THREE possible alternatives for removing the 60-cycle Holtwood substation from risk of repetition of 1936 flood damage (Figs. 1 and 2) it was decided to elevate the station in its existing location along the station tailrace. Availability of a strengthened diversion wall (the original one failed in the 1936 flood and incapacitated the substation) and the infrequency of damaging floods in the lower Susquehanna militated against removal of the station to higher ground, and it was undesirable to reproduce it in the same location.

By rebuilding the yard in sections it was possible to maintain service from this substation throughout the reconstruction period. Advantage was taken of the opportunity to add fire protection and other needed improvements in the station. The yard is now designed to withstand a flood of 1,250,000 cfs., which is 50 per cent in excess of the 1936 record of 860,000 cfs.

Steel structure raised

Preliminary measuring, fitting and drilling and other details of construction preparation were carried on with equipment de-energized, but available for service on short notice. Work involving interference with power conductors or relocation of major equipment was scheduled and carried out only after all possible preliminary erection had been completed and the outage period could be determined and controlled.

The existing steel structure was raised 9 ft. to accommodate the elevated equipment below. To minimize

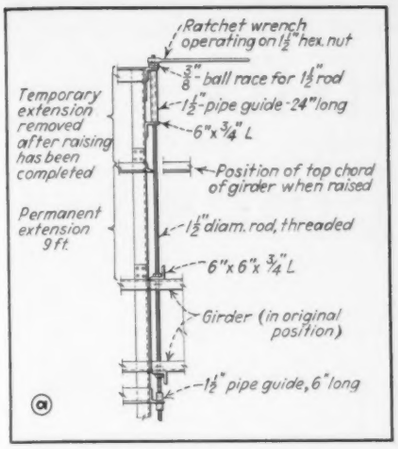

Ratchet wrench operating on 1½" hex. nut
⅜" ball race for 1½" rod
1½" pipe guide 24" long
6" x ¾" L
Temporary extension removed after raising has been completed
Position of top chord of girder when raised
Permanent extension 9 ft.
1½" diam. rod, threaded
6" x 6" x ¾" L
Girder (in original position)
1½" pipe guide, 6" long
a

Fig. 3 — Ratchet-operated elevating rods raise the successive sections of the substation structure

(a) Two 18-ft. 1½-in. diameter rods, threaded and operating in pipe guides, were installed at each end of each girder. These were tightly bolted to the upper and lower chords of the girder to be elevated and the entire assembly was suspended from the column extension by a ball race and 1½-in. hex. nut.
(b) After the equipment (a) had been installed during preliminary outage periods the connections tying the girders to the columns were removed and with a man operating a ratchet wrench on each supporting hex. nut the desired section was raised.

outage and interference to service this was accomplished by first installing a 9-ft. extension at the top of each column (Fig. 3) and then elevating the entire upper girder structure of one or two bays with switches, operating rods and insulators intact, by means of a number of ratchet-operated elevating rods. A total outage of eighteen hours of preparatory and final work was required for elevating two bays, of which time three hours was employed in the actual lifting of steel and equipment.

Transformer handling at the new elevation was complicated by the fact that the new foundations were 9 ft. above the original handling track. This track could not be relocated as it served other portions of the plant, and at this time was in continuous service for concrete trains transporting material for the new deflection wall. Although the additional capital investment involved in providing new permanent transfer facilities appeared relatively large when compared to that required for jacking the four units 9 ft., it was felt that these costs were comparable if such items as interference to concrete production, labor and ma-

[*Continued on page 92*]

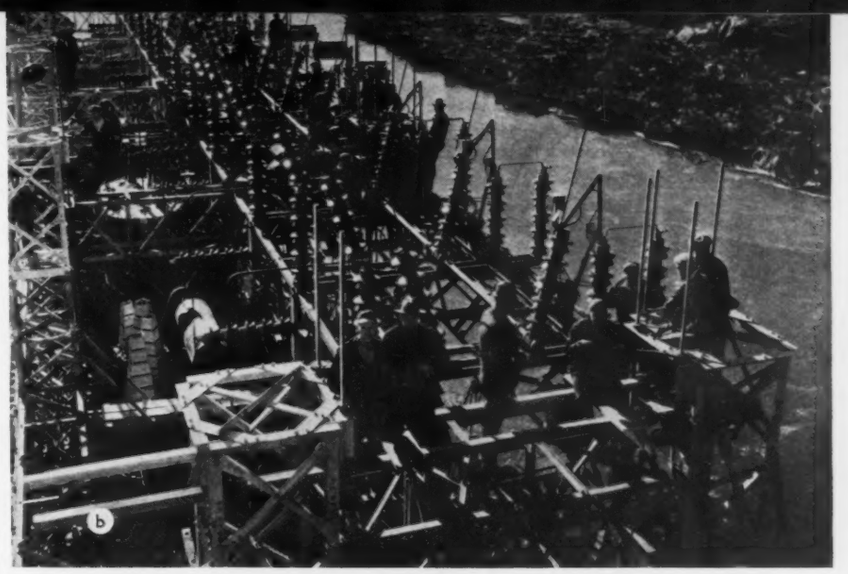


Fig. 4—Transformers were raised 9 ft.

The foundation extensions for the four units were of structural shapes salvaged from previous construction operations, cut to dimension in the shop and welded in place in the field. Gussets and cross-bracing provide ample stiffness. This design eliminated entirely the time required for concrete foundations to set and in addition a saving of $4,000 (represented both in material and labor) over the cost of concrete extensions was achieved, as it would have been necessary to cofferdam and excavate to rock for the concrete installation.

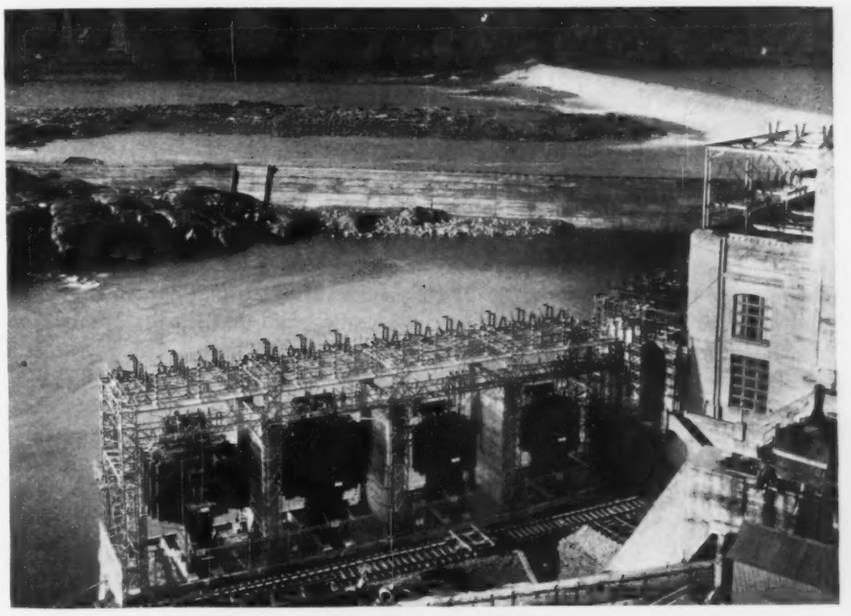


Fig. 5—Transformer station now above flood level—units elevated, rehabilitated and separated by fire barriers

Too Much Diversity in System Fuse Links

Fewer sizes, more uniform spacing between ratings, agreement on one curve shape for time-current characteristics will simplify problems of operating engineer and manufacturer

By E. F. BOOTHE

Research Engineer James R. Kearney Corporation, St. Louis, Mo.

POWER utilities, in their earnest desire to give service with the least possible amount of unnecessary interruption, have made extensive studies to determine the exact time-current characteristics of fuses which are best suited for system co-ordination problems. Manufacturing companies, in their efforts to provide fuse links with the desired time-current characteristics, have gone to great lengths in research and design, and have made remarkable progress in the art. These efforts indicate a commendable willingness to serve and a commendable spirt of co-operation on the part of both the utility and the manufacturer—the only distressing part of it being that the net result is a state of affairs of such confusion that the desired results are not often obtained.

Utilities find themselves burdened with the problem of choosing from a vast array of fuse links of fast, medium and slow time-current characteristics, of stocking the ones thought to give the desired results and of differentiating between those which carry the same rating marks but have radically different time-current characteristics. The desire to obtain duplicate sources of supply is complicated by the fact that the present standard among manufacturers does not effectively limit the carrying capacity or the melting characteristics of a fuse. There is a standard, to be sure, but the standard is so broad and the interval between sizes is so small that there is much overlapping between adjacent sizes.

Manufacturers find themselves burdened with the large expense of designing special lines of fuse links with time-current characteristics as specified by various utilities, of stocking the parts and materials as needed for prompt delivery of orders and with the problem of disposing of the stock which becomes obsolete when the sole user of some special line decides to use faster or slower fuses.

National Electrical Manufacturers Association in its program of standardization is attempting to bring some degree of order out of this chaotic condition by the elimination of any unnecessary fuse sizes and curve shapes and the addition of any necessary ones.

The present trend of thought is to standardize on but one line of fuse links of some well-defined shape, with no provision for the different fast or slow types which are now in use. While at first glance this seems to deprive the utility of something of considerable use, it is well to consider the matter carefully as regards benefits, as well as objections, to see which may outweigh the other.

Benefits of large selection

The benefit from two lines of fuse links is in the fact that a fuse with a slow sloping characteristic curve in the one-second-to-five-minute range of time permits close overload protection of motor-loaded transformers, while a fuse with a very steep characteristic curve in the same range of time permits close co-ordination with relays. We must be careful, however, to consider this in the light of actual conditions of practice, not in the light of theoretically ideal conditions.

For example, if we knew for certain that the motor-starting demand curve would always follow line A in Fig. 1, and if we were able to make a fuse link follow line B, we would then have ideal conditions of protection. But in practice we must allow for variations in the demand curve, and we are unable to obtain a fuse curve of that exact shape, so we must compromise by using a fuse of time-current characteristics

Fuse ratings are a subject of active discussion at the present time. This article advocates a single line of standardized ratings. Admittedly there are other schools of thought and* ELECTRICAL WORLD *pages will gladly publish further discussion that can be judged a constructive contribution, because an early clarification of the status of fusing should prove generally beneficial.

as in curve C. Likewise, for co-ordination with relay curve D, we are unable to get the ideal curve E, but must compromise with a curve such as F.

The actual benefit of having the two curves C and F available for use in place of only one standard curve H is measured by comparing the relation of C to A with the relation of H to A and the relation of F to D with the relation of H to D.

Disadvantages of large selection

One objectionable feature of carrying two or more lines of fuses in stock is the possibility of error in replacing a blown fuse with another of the same ampere rating but of the wrong type. This condition is illustrated in Fig. 2, where fuse curve A gives the desired protection, while fuse curve B intersects the motor-starting demand curve. If fuse A is specified and fuse B is inadvertently used, the result will be an unnecessary interruption of service. Reports from the field indicate that such mistakes are occasionally made in spite of all precautions.

Another important point to consider is the fact that unusually fast or unusually slow time-current characteristic curves are often obtainable only at the expense of some other important characteristic, such as strength or temperature. For example, in Fig. 3 curve A gives the desired protection at the knee of the starting curve, but curve B is desired to give closer overload protection in the long-time range. Curve B can be obtained by placing the element in tension so that it will gradually elongate and break at low overloads or by using a fuse body small enough to permit the overload temperature to build up high enough to melt the element. The first method decreases the strength of the fuse at normal loads, while the second method increases the operating temperature at normal loads. So, before deciding definitely to standardize on curve B, it is well to consider the other important characteristics. Then, perhaps, curve A would be chosen, even though it does not give quite such close low overload protection.

The answer to the question of whether there will be but one standard line or two or more lines with different time-current characteristics

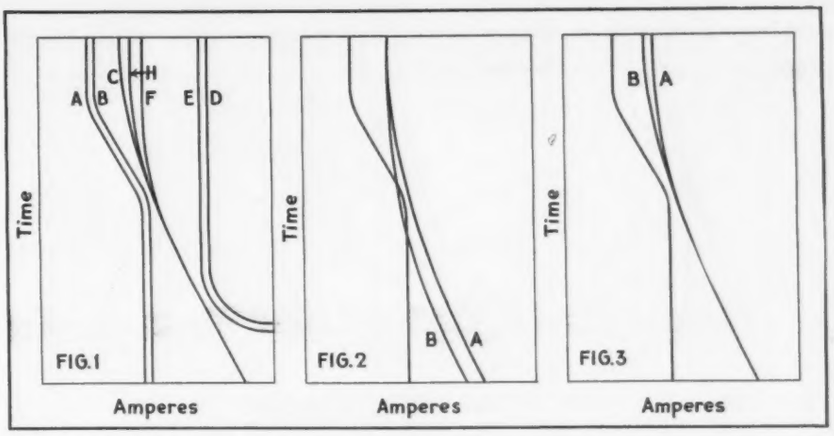
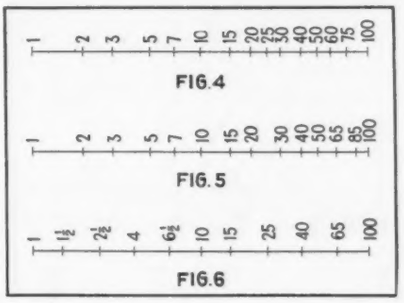


Fig. 1—Diverse requirements of motor starting and relay co-ordination. Fig. 2—Danger of wrong fuse selection. Fig. 3—Desired characteristics obtained at expense of others



Figs. 4, 5 and 6—Fewer sizes and better rating intervals

rests largely with the power utilities. Our endeavor is merely to present such facts as we have available to aid the utilities in arriving at the most advantageous decision in the matter.

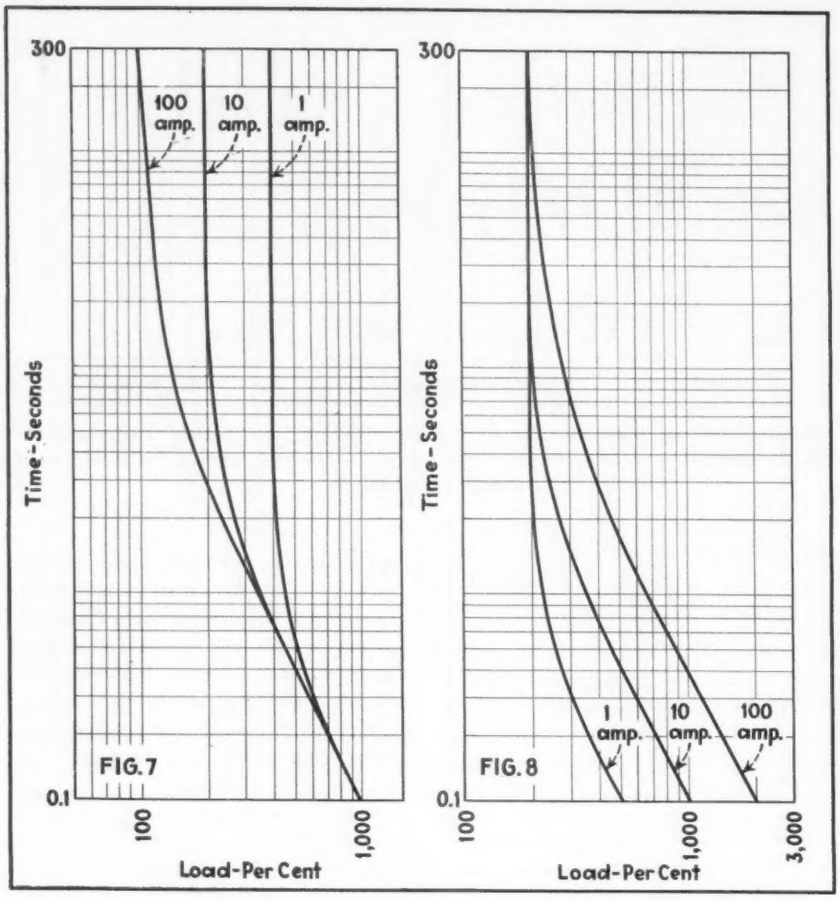
Choice of rating values

Next important matter for consideration is the choice of ampere rating values. Since transformers of various kva. ratings are used on lines of various kv. ratings, and since different utilities desire to use different ratios of fuse rating to load amperes, it is obviously impractical to have an exact size for each exact load. The best that can be done under these circumstances is to have a line of sizes, with the interval between sizes small enough to permit the selection of a fuse with a rating value fairly close to the exact value desired. The interval between sizes should also be large enough to prevent curves of adjacent sizes made by the same or different manufacturers from crossing each other. Considering that the interval between sizes should be as small as practical, and at the same time as large as practical, it is obvious that a uniform interval would be the best possible distribution. If the interval between any two sizes is made larger than necessary, then the resulting interval between some other two sizes will be smaller than necessary.

The old familiar list of standard sizes is shown in Fig. 4, spaced on logarithmic scale for easy comparison of the interval between sizes. Here there are fifteen sizes and the interval between sizes varies from a maximum of 100 per cent between the 1 and 2 ampere to a minimum of 20 per cent between the 25 and 30 ampere.

This gives indication of being a splendid opportunity to improve the usefulness of the line by a redistribution to decrease the maximum interval and to lower production costs and prevent conflict of curves by the elimination of unnecessarily close sizes. If an increase of 50 per cent as between the 10 and 15 ampere size is assumed to give the right interval, then the 100 per cent increase from the 1 to the 2 ampere is excessive and a 1½ ampere size would improve the usefulness of the line. Also, if the interval from 10 to 15 ampere rating is acceptable it seems logical that an interval increase from 50 to 75 amperes would be acceptable, which would eliminate one size and lower costs.

Now to examine the latest list tentatively approved as N.E.M.A. Standards, shown in Fig. 5 on logarithmic scale. Here there are fourteen sizes and the interval between sizes varies from a maximum of 100



Figs. 7 and 8—Opening characteristics are flexible but not parallel

per cent to a minimum of 17½ per cent. There is a reduction of one in number, but the distribution is slightly worse than before, which is surely not the greatest improvement that can be made.

We know from a review of the sales records of our company that few, if any, utilities attempt to make use of the entire present line of sizes. In the range of current between 10 and 100 amperes one customer uses 10, 20, 30, 50, 75 and 100 ampere sizes, while another uses 10, 15, 25, 40, 60 and 100 ampere sizes. Each one helps to pay the overhead cost of the sizes used by the other, and neither has so good a selection as would be possible with better distribution of fewer sizes.

With this same range of current covered by 10, 15, 25, 40, 65 and 100 ampere sizes we would need to produce only six sizes in place of ten and each customer would have as many sizes available for practical selectivity as now, with better distribution. The same system applied to the lower range of current would give no further reduction in number of sizes, but would give a marked improvement in selective operation and in application to a given load because of more uniform distribution.

The list of sizes shown in Fig. 6 on logarithmic scale was first suggested in August of 1936 as a possible means of eliminating the confusion and reducing the expense which then existed, and is again brought to attention for further consideration.

Comparing this list with the old standard list, the decrease in maximum interval between sizes from 100 per cent to 67 per cent would make possible the selection of a size close enough to a given load for all practical purposes and closer than is now possible in some instances. The increase in minimum interval between sizes from 20 per cent to 50 per cent gives sufficient leeway so that there should be no conflict between adjacent sizes made by different manufacturers to reasonably close tolerances. The reduction in total number of sizes from fifteen to eleven would result in a considerable reduction in manufacturing development and production expense.

Shapes of time-current curves

The next major problem in line for consideration is that of the most desirable slope or shape of the time-current characteristic curves. There is such difference of opinion among utilities as regards the most desirable slope and such differences in construction among manufacturers that the problem of arriving at a satisfactory standard assumes formidable proportions. We believe, however, that the prospective benefits of such a standard are sufficient to warrant a sincere effort and the making of some concessions on the part of every one who is concerned to secure them.

The slope of time-current curves can be indicated by the ratio of current which will melt the element in

[*Continued on page 97*]

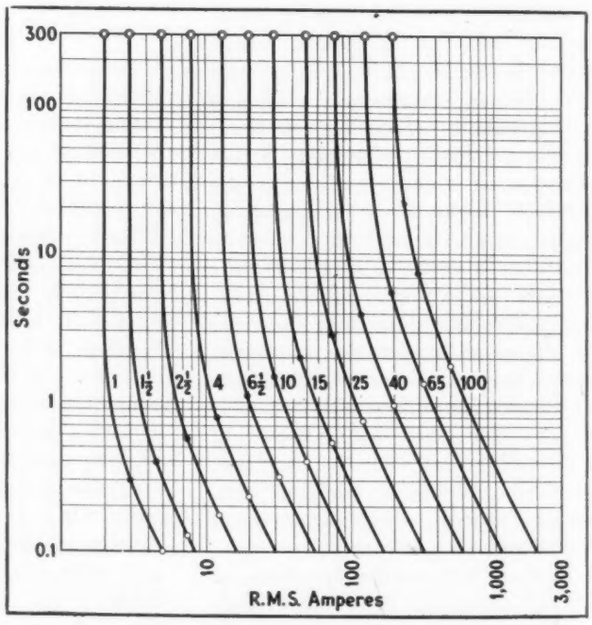
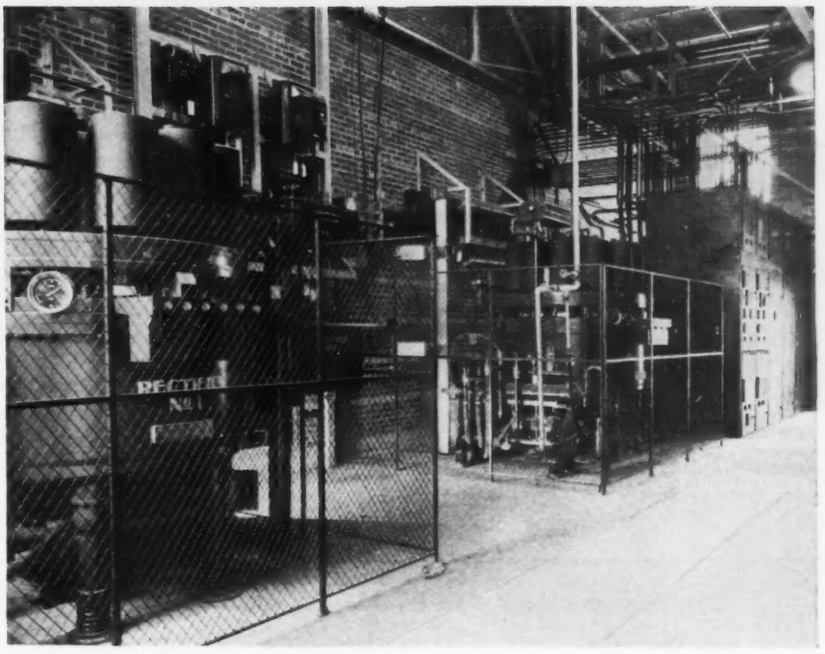


Fig. 9—Non-parallelism of opening time curves allows better rating intervals



Two of four rectifiers supply 500 volts d.c. for chlorine generators

Rectifiers (four tanks in all), a.c. control switchgear for the rectifiers, auxiliary power distribution switchgear, cathode, circuit breakers and direct-current power distribution switchgear are in one room. The transformers are located outdoors. Incoming feeder switchgear and rectifier transformer primary switching equipment are in the center of the room, with two rectifiers to the right and two to the left. This switchgear is of the single bus, metal-inclosed cubicle type with control relays, meters and control switches mounted on the front swing doors. Oil circuit breakers and high-voltage conductors are separated from the control section by steel partitions.

Arc Rectifiers Succeed in Chlorine Production

By L. J. RIMLINGER

Columbia Chemical Division, Pittsburgh Plate Glass Company, Barberton, Ohio

FOR the electrolytic production of chlorine the converting equipment was chosen to be mercury-arc rectifiers because of their low operating cost, high efficiency and their suitability in corrosive atmosphere. They require less attendance and are immune to corrosion of working parts that can cause failures. They are foolproof against reverse polarity, which is highly dangerous, and operators require no special training for routine operation.

Efficiency and availability high

The over-all input conversion efficiency has been as high as 94.1 per cent and the average monthly efficiency has been 93.4 per cent.

Load factors have been high and have a yearly average of 93 per cent. No standby capacity is available.

Outage chargeable to rectifiers in the past year is approximately 5 per cent of the total operating time; 4 per cent of these outages occurred in the first seven months of operation.

This is very good when it is to be considered that we have had no previous rectifier experience and have had to depend on the factory for service. In several cases we have corrected the trouble without factory advice or service and in one case it was necessary to open the tank to the atmosphere, necessitating forming before putting back in service.

The chief objection to rectifiers by engineers and operating men is the thought that rectifiers are a highly specialized piece of equipment and that they require the services of a specialist, when in trouble. They are also of the opinion that rectifiers cannot operate unless everything is functioning in perfect order and that with rotating equipment it is possible to operate at least after a fashion with minor troubles.

This is true of past performances of rectifiers, but in late years, due to design improvements and experience, most of the troubles have been corrected. Our experience of the past year has shown that they can be kept in operation with no more outage time than would be normally expected of rotating equipment. All of our troubles have been failure of the auxiliaries. We have had no troubles with the tanks.

Backfires occur under a variety of conditions and the exact cause cannot always be determined. The first three months of operation we averaged a backfire a week and the next three months a backfire a month. This has decreased in the last six months to a backfire every 60 days. Our experience in the past year indicates that they occur more frequently when operating with grid control with rectifier carrying a large percentage of full load.

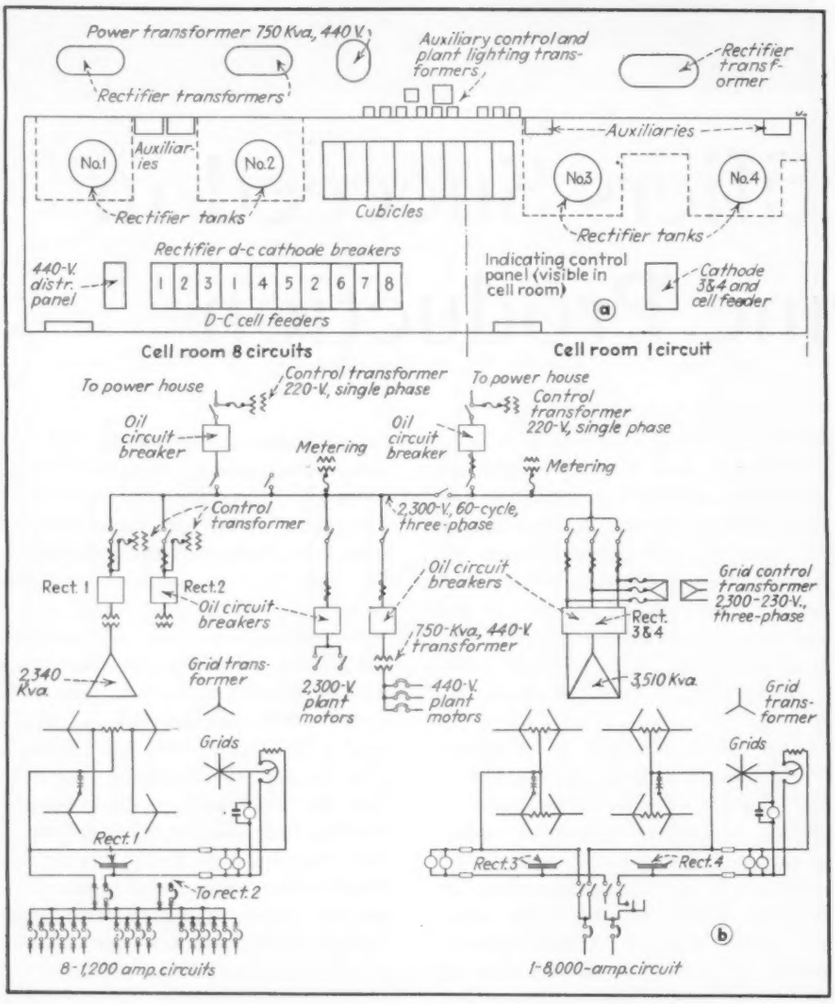
Where the rectifier is equipped with oversize vacuum pumping equipment there is no delay in getting back in operation. We have been able to put the rectifiers back on the line immediately after a backfire. Where pumping equipment is not oversize it is necessary to wait until the vacuum improves to a safe operating point.

This plant is one of the first to use 500 volts on chlorine cells and is one of the largest depending entirely on mercury-arc rectifiers. The operation of the plant at 500 volts has produced no difficulties electrically on the distribution system, but has caused increased electrolysis on the feeder pipe lines to the cells. Changes have been made that have partly reduced this condition, by using non-conducting material for these lines and using drains to carry off the leakage current. Operation at this voltage is not hazardous to the operators and the tendency is toward higher voltage.

Continuous overload capacity of rectifiers has been a matter of considerable discussion. That rectifiers are advantageous in this respect is shown by the fact that in the past year we have carried 125 per cent load for eight days 24 hours continuous. There has been no apparent visible harm that could be detected without opening the tank.

The overload ability is somewhat determined by the amount and duration of the overload. Continuous overloading increases the rate of metalization of insulators, which, in turn, increases the frequency of backfire. With too frequent backfires more overhauls are necessary, with the resultant cost and loss of production.

In a recent month we carried 10 per cent overload continuously and had no increase in frequency of backfires. The only trace of possible effects of overloading that have been noticed to date is sagging of the castings supporting the carbon grids. This was noticed at the last opening of one of the original rectifiers, which had previously carried overload for only a few hours at a time.



Rectifiers are double six-phase with twelve anodes

There are two rectifiers in the first section, each having a rating of 2,000 k.w., 500 volts d.c., with twelve anodes, double six-phase, 4,000 amp. full load continuous capacity and 5,000 amp. for two hours after carrying full load continuously. Each rectifier is connected to individual transformers with 2,300-volt, 60-cycle, delta-connected primary.

Secondaries are connected double six-phase wye with interphase transformer mounted inside of the main transformer tank. Secondaries and the interphase transformer windings are arranged for parallel operation at 500-volt d.c. and series for 1,000-volt operation.

Rectifiers have a rating of 2,800 kw. at 1,000 volts, operated with forced-air cooling fans on the transformers.

Transformers are of the shell type, all insulated, self-cooled, outdoor type. They have a rating of 2,340 kva.

Double and quadruple six-phase

Operation of the first of the two sections of the plant began in August, 1936, and the second section started operation on October 4, 1937. The latter has a 3,000-kw. rectifier, 500 volts, d.c., two tanks operating on one transformer, twelve anodes each, double six-phase having a rating of 6,000 amp. full load continuous and 7,500 amp. for two hours, after carrying full load continuously. Tanks are duplicate of the rectifiers in the first section except for the omission of internal cooling and air cooled in place of water cooled anodes. Auxiliaries are duplicated on each unit and each tank with its auxiliaries can be operated independent of the other at full load and overload rating of one tank.

The transformer is a duplicate of the transformers in the first section except that it is quadruple six-phase, with one primary winding delta connected and two separate double six-phase secondary windings with two interphase transformers, and has no series parallel arrangements for 5,000/1,000-volt operation. The transformer has a full load rating of 3,510 kva.

Air circuit breakers employed

Air circuit breakers (d.c.) are employed for the rectifier cathodes and cell feeders of the first section. The cathode breakers are single-pole, 6,000-amp., semi-high-speed, 3½-cycle breakers, with direct-acting instantaneous reverse power trip. The cell feeders are two pole, rated 1,600 amp., with five-cycle, time-delay, direct-acting overload trip on both poles. The cathode breakers, together with the cell feeders, are completely inclosed and are mounted on roll-out trucks, with plug and socket connections in the rear. Openings are provided in the top to permit the escape of ionized

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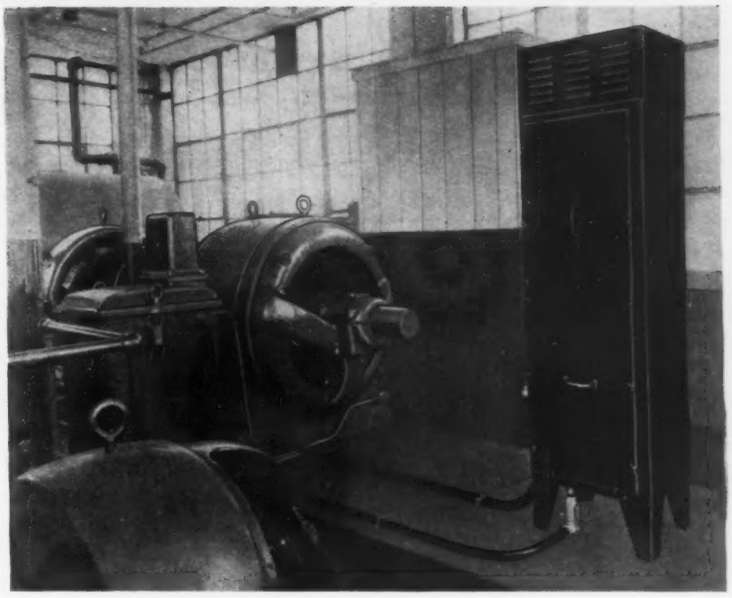


Synchronous motor and power factor regulator replacing light-loaded induction motor keep plant power factor above 90 per cent

H. L. WILCOX
Assistant Chief Engineer
Electric Controller & Manufacturing Company, Cleveland, Ohio

Save $75 Monthly by Raising Power Factor

WHEN it was found that monthly savings in power cost realized from the installation of modern equipment for correction and control of plant power factor far exceeded the amount required to justify the $4,000 investment required the necessary equipment was quickly installed in the Cleveland, Ohio, plant of the Electric Controller & Manufacturing Company. A saving of $76.50 in demand charges was realized during the first four weeks of operation.

An itemized breakdown of a typical plant power bill prior to correction of power factor is given in Table I. Under the power contract in effect the only opportunity for economy lay in reducing the demand charge. This contract was based on an average plant power factor of 75 per cent. If plant power factor was raised above 75 per cent, demand was reduced in billing by the ratio of 75 to the actual average power factor. Under the contract demand charge in dollars was equal to $\frac{D \times 0.75}{pf} + 50$, where D was the average monthly demand as read and pf is the new power factor. Thus, for example, if the power factor in Table I had been 100, the demand charge by the above equation would have been $323 instead of $414.

An analysis of twelve consecutive monthly bills in Table II shows that this customer could save $60 per month by raising his power factor to 90 per cent, $75 per month by raising it to 95 per cent and $90 per month by raising it to 100 per cent.

Studies were made with a graphic wattmeter and power-factor meters to determine how power factor varied throughout the day and how much corrective capacity would be required. Records for the heaviest day showed a maximum kva. demand of 434 at 75 per cent power factor, corresponding to an r.-kva. peak of 287. Since it would have required the full corrective capacity of a 375-hp. 80 per cent power-factor synchronous motor to supply this peak r.-kva., and then for only an hour, it was not deemed economical to raise the power factor to 100 per cent.

A 150-hp. induction motor used in this plant to drive a 100-kw., 220-volt d.c. generator carried an average load of 80 kw. at 65 per cent power factor. By replacing the induction motor with a 150-hp. 80 per cent power-factor synchronous motor the lagging 61 r.-kva. of the induction motor would be eliminated and 91 corrective reading r.-kva. would replace it, making a total reduction in plant r.-kva. of 154. This reduction would cut the peak kva. from 434 to 352 and boost power factor well above 90 per cent.

[*Continued on page 96*]

Table I—Typical Month's Power Bill—Before Correction

Demand charge, kw.-hr.		
50 at $2 per month each	$100.00	
314 at $1 per month each	314.00	
364 total at an av. P.F. of 0.677		$414.00
Kilowatt-hour charge, kw-hr.		
40,000 units at 0.013	$520.00	
43,040 units at 0.009	387.00	
83,040 units total		$907.36
Total charge		$1,321.36

Developing Load on Existing Rural Lines

Problem presented by farms adjacent to rural lines, but not taking service, has been solved by the Alabama Power Company

By E. C. EASTER

Manager Rural and Towns Division, Alabama Power Company, Birmingham, Ala.

IN MOST rural communities of Alabama there are some families anxious for electric service. There are others who will voluntarily connect to the line if constructed, and the balance, which ordinarily represents from 60 to 80 per cent of the total, would like to see the lines built for their possible future convenience, but are not immediately interested or are not in a position to have their houses wired and buy the fixtures and appliances required even for the limited uses of the service.

Before the lines are constructed the citizens of the community who are anxious for the service can get their neighbors to sign petitions and applications for service, and it is therefore usually not difficult to get a large per cent of the total potential customers to "sign up" for the service.

However, to get the prospective customers connected to the line and using sufficient amounts of the service to make it economical to them and to the company is a more difficult problem. A majority of the farms are occupied by tenants and the owners are usually hesitant about having the premises wired for service.

The income of most of the owners is small and usually sufficiently uncertain to make them hesitant about spending money to have their houses wired and for the purchase of electrical equipment. Particularly during the spring and fall seasons the farmers are busy with their crops and are slow to take the time to have

E. C. Easter

their houses wired. And in many of the communities it is difficult to get wiring contractors to wire the occasional house in the country. In an effort to overcome those and other difficulties in obtaining the maximum possible number of customers on its rural lines the company introduced the following plan in the early part of 1936:

The agricultural engineers of the company made a survey of the "non-customers" located on the existing rural lines for the purpose of making a record of those who were not using the service, with pertinent information as to their circumstances, and to call to their attention that they could use electric service at a nominal cost. For example, they talked up "lighting, iron and radio for about $2 per month," and other uses in which the prospective customer indicated an interest.

Those surveys provided a systematic plan of contacting all of the non-customers and resulted in a record of each which indicated whether or not he was then or probably would be a prospect for service. The records of each line surveyed were kept as a guide for future efforts in the solicitation of customers.

To encourage our agricultural engineers in their travels throughout the system, in the solicitation of potential customers located adjacent to existing lines, the company introduced the payment of commissions to the agricultural engineers for obtaining new customers on existing lines as follows:

For each such rural customer..	$2.00 plus
The following additional commission for each of the following appliances sold by any one (including dealers) to such new customer within three months after connection:	
Water pump	0.50
Household refrigerator ..	1.00
Range	1.50
Water heater	2.00

An existing rural line is considered as one that has been in operation for three months or more.

During the year 1936 there was a net increase of 2,206 customers on the company's rural lines that were in operation at the beginning of the year. This represented an increase of 22 per cent in the number of customers on those lines.

For the first nine months of 1937, 2,188 new customers have been added

to the company's existing lines, including those that were built in 1936 and the first half of 1937, and there are approximately 3,000 prospective customers on the presently existing lines that we estimate can be added by a continuation of these efforts, provided economic conditions continue at the present level.

Use must be developed

Particularly with the addition of a great number of rural customers, it is very important that their uses of electric service be developed to increase the value of the service to the customers and to the company.

Years of experience have taught the utilities generally that the rural line load will not develop without (1) an aggressive program to familiarize the customers with the uses of electricity, (2) assistance in the solution of the problems involved in making profitable and satisfactory applications, and (3) a sales program.

Various plans have been tried, such as requiring customers to agree to purchase certain equipment before the lines are built, requiring the customers to guarantee an increased minimum bill on the theory that they will use up at least the energy allowed for the monthly minimum, and other provisions designed to assure an increased usage and at least a minimum revenue.

However, in the end the customer is going to use electricity only for the purposes that he wants to and that he is able to afford, and the revenue that those uses will produce at the rate that is applicable is all that the utility can expect from the service. Therefore, the only way to develop increased uses by the customers and approach satisfactory revenues to the company is through constant and repeated contacts with the customers to develop their desires for practical, satisfactory and economical applications of electric service, and in many instances to assist them in making their electric service increase their incomes at least sufficiently to pay the monthly bill.

Since 1926 the company has employed these agricultural engineers to conduct an educational and promotional program with the rural customers and has continuously increased the uses and value of electric service to the existing rural customers, as indicated by the increase in average annual kilowatt-hours per customer from 246 in 1926 to 1,206 in 1936, an increase of 169 per cent.

During the year 1936 the kilowatt-hour sales on rural lines in operation at the beginning of the year increased by 3,970,000 or 37.3 per cent. Average use per customer increased 126 kilowatt-hours, or 10.7 per cent. The revenue from those lines increased $114,000, or 23.5 per cent, and the average rate per kilowatt-hour declined 0.44 cent, or 9.8 per cent.

With the rapid increase in rural customers and the growing distance from the company's offices and stores, the importance and difficulty of the promotional work is increasing. With the continuation of extending service into the more thinly populated areas increased uses of the service are becoming more essential to successful rural electrification.

In any consideration or survey of rural electrification in Alabama, particularly if the performance is to be compared with performance elsewhere, certain factors which have influenced it must be kept in mind.

Territory characteristics

Alabama has many capable, efficient and progressive farmers, and within the past decade they have made remarkable advancement in improvement of farming practice, particularly in the development of more fertile soils, which are of necessity essential to agricultural prosperity.

Despite this progress, however, there still remain certain factors pertaining to Alabama agriculture which have tended to make general rural electrification difficult. Some of them are:

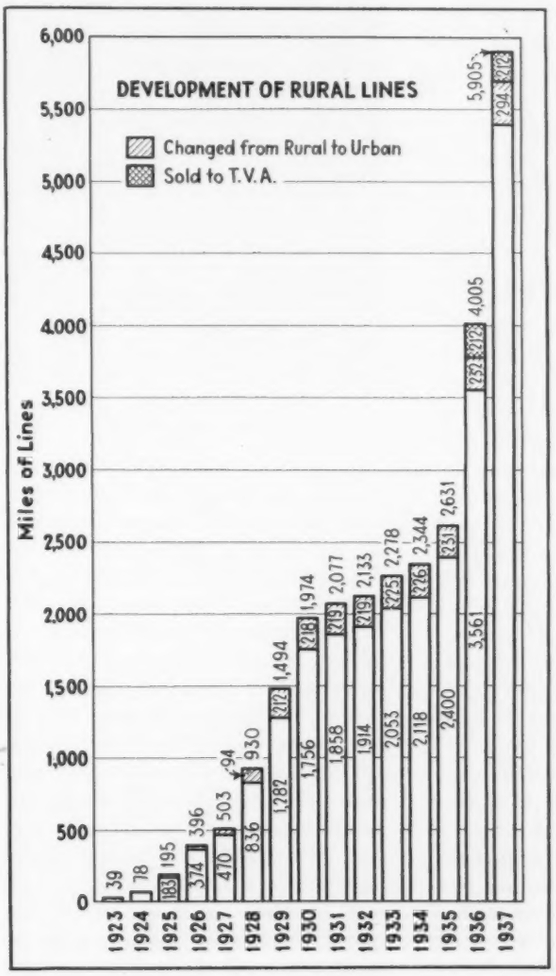
1. Alabama ranks 46th in farm income per capita, with $141 against a national average of $273.*

2. According to the 1930 Census, 80.4 per cent of the farms in the state were classed as cotton farms. There has not yet been developed any practical use of electric service in connection with the production of cotton except the cotton gin, which requires heavy equipment with only seasonal operation. Therefore, the present use of electric service on the cotton farm is restricted to the home, and as the income of the cotton farmer has until the last year or two been so generally uncertain, such farmers are forced to carefully husband their cash resources.

3. In 1935 only 30 per cent of the farms in Alabama were operated by the owners, and rural electrification is, of course, more difficult where the farms are operated by tenants.

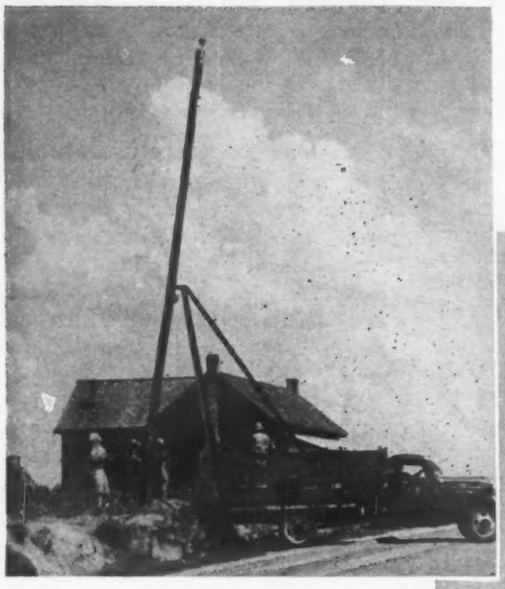
4. One-third of Alabama farms are operated by negroes, of which 87 per cent are tenants and share-croppers. In many counties of Alabama a majority of the farms are operated by negroes.

Offsetting, in part, these conditions, which make rural electrification more difficult than in relatively thickly settled farming areas with a diversity of crops, are a long growing season, abundant rainfall and a mild climate.

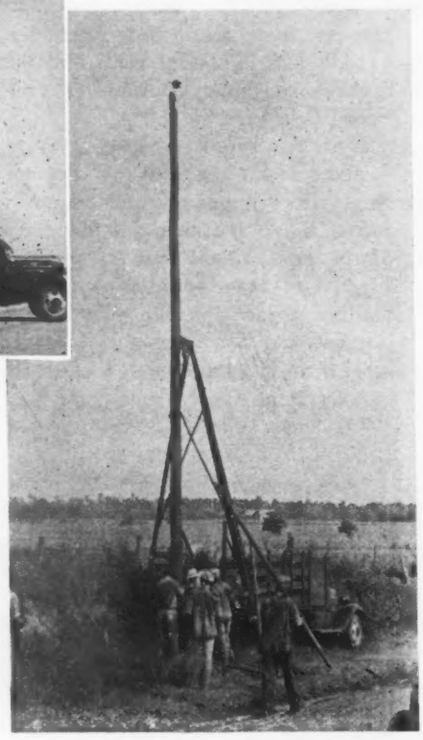


Development of rural lines by Alabama Power Company. Figures for 1937, submitted in advance, are subject to correction

* Maurice Levan, Harold G. Moulton and Clark Warburton in "America's Capacity to Consume," page 173 (Brookings Institute, Washington, D. C., 1934).



Rural lines under construction by Alabama Power Company. For pole hole digging, pole setting and other such tasks the company employs people residing in the locality of the construction job



At the close of June, 1937, Alabama Power Company was providing service directly to consumers in 594 cities, towns, villages and communities in 63 of the 67 counties of Alabama. Thirty-five of these had populations of 2,501 or over and 559 are listed as having 2,500 or less inhabitants.

The United States Bureau of the Census defines urban population as that residing in cities and other incorporated places having 2,500 inhabitants or more; the remainder is rural. In June, 1937, of the 130,600 retail customer meters served by Alabama Power Company, approximately 51,000 or 39 per cent, were located outside of any incorporated place of 2,500 inhabitants or more and would, therefore, be classed as rural by the Census Bureau.

However, the company's definition of a rural line is generally "an electric distribution line of 11,000 volts or less, not within the corporate limits of a municipality, which serves less than 20 customers per mile of pole line." In June, 1937, Alabama Power Company was serving 19,571 customers from 4,519 miles of rural lines, according to this definition.

The growth of rural electrification on the Alabama Power Company system from 1923 through 1937 is indicated on the accompanying chart. It will be observed that within that period the company has constructed a total of 5,905 miles of rural lines, some of which have been transferred to "urban" classification and others sold to the TVA. Under this construction program it has extended electric service to an average of 1,550 additional rural customers annually. Present density of customers on rural lines is 4.33 customers per mile of line.

Organized selling

Prior to the construction of a line, at the community meeting usually held to explain the rates, uses of service, house wiring and other matters pertaining to getting the service established are discussed with each individual at the time applications for service are signed. After the completion of the line salesmen of the power company and dealers, particularly radio and refrigerator dealers, call on the new customers and make sales to those whose premises are ready and who are in a position to buy. After service has been available for about a year the customers have in most cases paid for the wiring, have become more familiar with the convenience of electric service and further intensive load-building efforts follow.

The company advertises regularly in all weekly newspapers having a circulation among its rural customers, distributes to selected lists special publications treating of the use of electricity on the farm and places all new rural customers' names on a mailing list to receive literature on the various major devices. These names remain on the list until the equipment is purchased or until a request is received that the name be removed for some other reason.

Field rural load development is conducted under the general supervision of the agricultural engineers. They are familiar with the customers and the conditions in their communities, have had several years' study and experience in rural electrification and are familiar with the use of electric service generally, and particularly with the application of electric service to farm conditions. They conduct community meetings mentioned above where they explain, illustrate and demonstrate uses of electric services and discuss with individual rural customers the possible additional uses of electric service. They do not sell any equipment or receive any commissions for equipment sold, but act as "consulting rural engineers" for farm customers, to assist them in obtaining and operating their electrical equipment. They co-operate with independent dealer, the sales and field managers of the power company and give customers the necessary assistance in their selection of suitable equipment. During 1936 Alabama Power Company's agricultural engineers conducted 150 meetings in rural communities, attended by 10,000 persons. Personal contacts with individuals to explain the advantage of a general use of electric service were made with 3,047 rural customers.

In addition to the activities of the agricultural engineers, other classes of employees help in the development of load on the rural lines. Among them are the dealer co-operative representatives, home economists, lighting representatives, merchandise salesmen, refrigeration engineers, local managers, service men, members of construction crews, cashiers, meter readers. During 1936 rural customers installed approximately 1,596 household refrigerators, 50 commercial refrigerators, 597 electric ranges, 825 water pumps, 108 water heaters and num-

[*Continued on page 93*]

Short-Time Heating of Insulated Cables

Economies may be achieved in choice of cables for short-time service by taking account of heat absorption and transfer — Methods and data are given

By R. M. SENSINTAFFAR

Electrical Engineering Design Section, U. S. Bureau of Reclamation, Denver

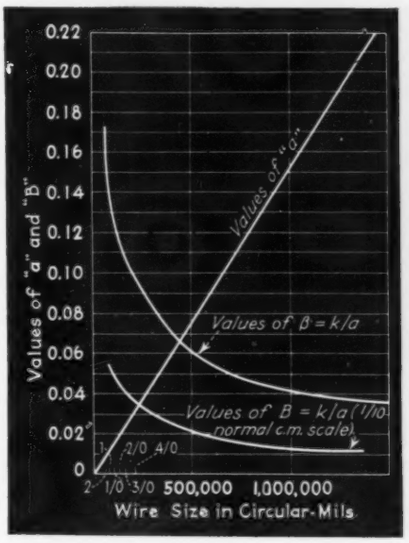
HEAVIER cable size than is necessary is often selected for short-time duty because the designer is not sufficiently familiar with characteristics of cables to choose the more economical size. This article gives practical information to enable a designer to select control cables for circuit breakers, cables subjected to intermittent loading or short circuits, and similar cases with a reasonable degree of accuracy.

Some designers in short-time calculations assume that all of the heat produced in the cable is absorbed by the copper and that none is conducted away. That such calculations are inaccurate for long time periods will be shown, and consequently a larger cable than is necessary is the result of such assumption.

The heat produced in a cable by the current it is carrying is partly absorbed by the cable and the balance conducted away to the surrounding media, both being proportional to the temperature rise.

Three charts have been devised to simplify calculations of short-time current-carrying capacities of cables, and by use of these, along with a few mathematical operations, such calculations can be made rapidly. The graphs are based on the solution of the differential equations of the heat transfer.

Values of the thermal capacity and time constants for cables in air are presented in Fig. 1. Thermal capacity is represented by a, which is given in watt-hours per foot per degree centigrade. The time constant, represented by B, is in reciprocal minutes and is the ratio of the heat-loss constant, represented by k in watt-hours per foot per degree centigrade per minute, and the thermal capacity, that is B, equals k/a.



Based on current-carrying capacities listed in National Electrical Code Handbook.

To derive values for ducts use approximately one-eighth the charted values for B and four times the value of a; this makes k for ducts one-half the value of k for air.

The lower graph (marked "1/10 normal scale") is for the purpose of obtaining values of B for small cable sizes by using the circular-milage scale for values of one-tenth its marked value and the B scale for ten times its marked value.

The temperature rise in a cable for a period of time less than one minute can be calculated with reasonable accuracy from either of the following equations:

$$\Theta = \Theta_o (I/I_o)^2 Bt \text{ or } \Theta = r_e I^2 t/60a$$

in which θ is the temperature rise in degrees centigrade, produced by the current I in amperes during the time t in minutes.

For the first equation Θ_o is the permissible temperature rise produced by the normal current I_o, and is 15 deg. C and 21.6 deg. C. for N.E.C. rubber and varnished cloth cables, respectively, in air and approximately twice this for ducts. For the second equation r_e is the effective resistance in ohms per foot. The values of a and B should be corrected if the cables are in ducts.

These equations are chiefly adaptable to short-circuited cables. For instance, if a 250,000-circ.mil N. E. C. rubber-insulated cable in air carries 1,000 amp. for ten seconds the temperature rise is 15 x (1,000/250)² x 0.091 x (10/60) or 0.000049 x (1,000)² x (10/60) / (60 x 0.0375), which equals 3.6 deg. C. rise.

Fig. 1—Thermal capacity and time constants for 600-volt cables in air

The value of k has been calculated for rubber-insulated cables in air on the basis of the National Electrical Code Handbook, current-carrying capacities being 60 per cent of those necessary to produce a 41.7 deg. C. temperature rise above the surrounding air or a 15 deg. C. rise for normal currents. The N.E.C. has established 41.7 deg. C. or 75 deg. F. as the permissible temperature rise.

The values of k for varnished cloth insulated cable, using current-carrying capacities as listed by N.E.C., which are 72 per cent of those necessary to produce a 41.7 deg. C. temperature rise above the surrounding air, give approximately the same value of k as for rubber-insulated cable.

The value of k calculated from several manufacturers' bulletins, for cables in air using current capacities as 100 per cent of those necessary to produce the permissible temperature rise, is slightly higher than those calculated above, as would be expected, since a factor safety is used by cable manufacturers to allow for overloads and unusual operating conditions.

In this article the value of k for ducts has been established as one-half the value of k for air. The basis for this is a number of calculations of actual duct conditions along with the author's experience in heat dissipation characteristics of ducts which verifies this ratio closely enough for practical purposes.

The value of a is for the copper

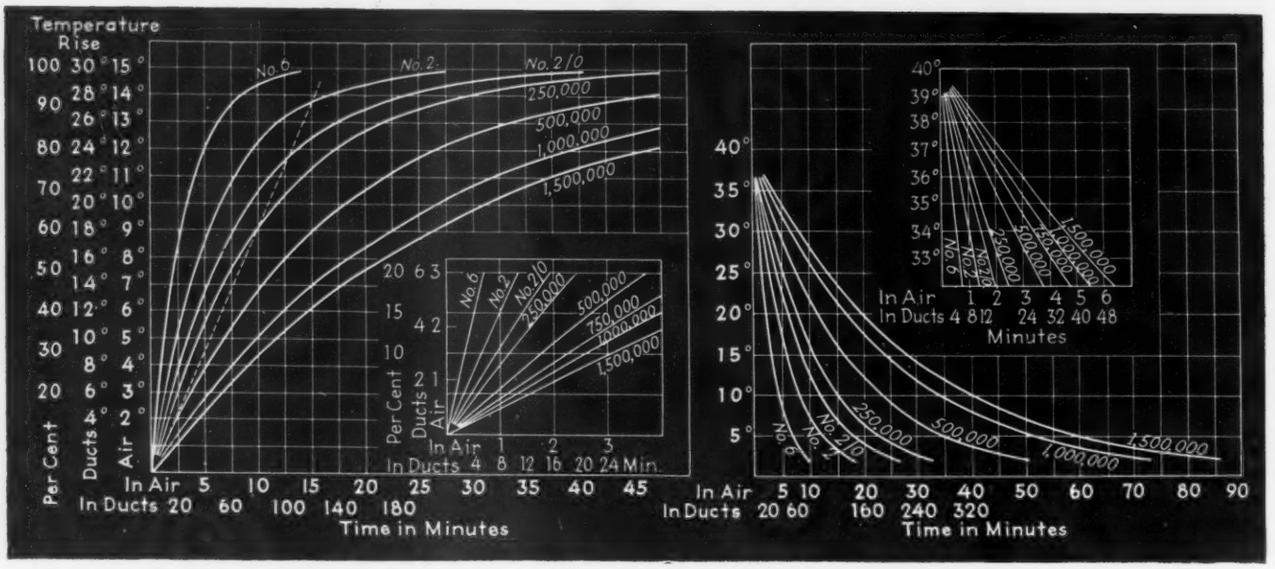


Fig. 2—Temperature rise of cables for periods longer than one minute

Fig. 2—Three θ_e scales are shown. One is for rubber-insulated cables in air carrying currents as listed by N.E.C. which produces a 15 deg. C. rise, one for rubber-insulated cables in ducts carrying currents listed by N.E.C. which produces a 30 deg. rise approximately, and one scale for percentage rise which can be used for other values of θ_e. The time scales corresponding must be used for air or for duct conditions due to the variation of k and B for air and ducts as mentioned previously. The small graph is for more accurate readings than are practical to obtain from the larger graph. For currents other than normal temperature rise must be multiplied by $(I/I^e)^2$.

Fig. 3—Values of temperature drop for cables cooling in air and in ducts

Fig. 3—θ_c is given for cables in air for $\theta_e = 40$ deg. C. To obtain values of θ_c for other values of θ_e multiply by ratio of new θ_e to the θ_e given in above chart. To obtain values of θ_c for ducts use time scale marked "in ducts." To obtain temperature drop for other sizes of cable interpolate on the basis of circular mils.

To obtain θ for other sizes of cables interpolate on the basis of circular mils.

only, and therefore the same for all types of insulation. This permits a desirable factor of safety for loaded cables in air on account of the absorption of heat by the insulation, and protective covering such as braid, lead, armor, etc. The value of a for the insulation of small high-voltage cables may be even larger than that for the copper. The weighted thermal capacity a of ducts varies considerably and the author has chosen a value of four as the approximate ratio of a for ducts to a for copper only. Since a is larger for cables in ducts than in air, both the heating and the cooling of the cables is retarded. If an approximate value of a is used the results of calculations of heating and cooling combined will be very close, because any errors in the calculation of the heating will be rectified in the calculation of the cooling.

Temperature rise in cables for periods longer than one minute is given in Fig. 2.

It will be noted that a dashed line has been placed tangent to the 500,000-circ.mil cable. This line represents the temperature rise in this cable if all of the heat produced had been absorbed by the copper, only. As mentioned before, and as is obvious from the graph, such calculations are inaccurate for long time periods.

The curves can be adapted to other types of cables by calculating the time constant B, which equals $r_e I_e^2/60a\theta_e$, then correcting the two scales for the new conditions. For instance, if a class of insulation permits a 50 deg. C. rise, then for a particular cable the time constant B' can be calculated. If t' is the time, then in Fig. 2 use the time equal to $B't'/B$, obtain the per cent rise and take this percentage of the 50 deg. C. permissible rise to get the rise in question.

An illustrative problem

Except that it shows temperature drops represented by θ, Fig. 3 is similar to Fig. 2. The θ_c and t scales can be changed as in Fig. 2 to meet other types of cable with the same degree of accuracy. In using graphs it must be remembered to use the correct scale for duct or air conditions. For the cable sizes not given on the graph interpolate on the basis of circular-milage.

To explain further the use of the graphs the following problem will be solved: To close a certain oil circuit breaker the current required is 300 amp. What size wire should be used if the operation doesn't exceed two seconds? It is advisable to take a period of time much longer than the actual closing operation, as in case of testing or trouble a number of repeated operations may be necessary. Therefore, eight minutes will be taken as the time, using N.E.C. rubber-insulated cables in ducts. Arbitrarily choose No. 1 cable, then from Fig. 2 normal current (100 amp.) produces a rise of 4.1 deg. C., and actual load current (300 amp.) produces a rise of $4.1 \times (300/100)^2$, or 37 deg. C. approximately, and the chosen cable size is appropriate as it has nearly the maximum permissible rise of 41.7 deg. C. If this cable were permitted to cool for 60 minutes, from Fig. 3 the temperature drop would be to approximately 13 deg. C. above the ambient temperature. This would permit loading again for five minutes if the temperature rise is limited to 41.7 deg. C., as is the case for the N.E.C. This is obtained by finding the time required to heat the cable to 13 deg. C., which is $13/(300/100)^2$ or 1.45 deg. C. for normal current and is about four minutes. The time required to heat the cable up to a 41.7 deg. C. rise is similarly 4.64 deg. C. for normal current or nine minutes, and the difference between nine minutes and four minutes is five minutes.

Revenue 3.5% Over Year Ago

November continues lead over 1936, but by a decreasing margin — Rising domestic use contrasts with the decline in wholesale power

WITH a revenue of $187,296,300 and a generated output of 9,314,573 000 kw.-hr., operations of the electric light and power industry during November surpassed all previous figures for that month. But the margin over a year ago was smaller than heretofore; revenue increased 3.5 per cent and output only 1.5 per cent, whereas as recently as August the gains were 7.3 and 10.2 per cent respectively.

It should be noted that in these figures, reported by the Edison Electric Institute, comparisons beginning with October are based on a revised monthly series which gives the revenue for that month in 1936 as $177,392,700 and the production as 9,596,629,000 kw.-hr. The revised November figures become $180,906,200 and 9,175,795,000 kw.-hr.

Both revenue and output, particularly the latter, reflect the recession in industrial activity. The breakdown of sales by classes of service shows this in detail.

Industrial consumption falls

The gain over a year ago in sales to domestic customers, 12.1 per cent, was approximately the same as in October and only moderately less than in the best months of the year. Small commercial sales at 13.5 per cent are holding up even better. But sales to wholesale consumers, chiefly for industrial power, have been declining month by month and in November were 17 per cent less than in August. Compared with 1936 a gain of 13 per cent in August was succeeded by 9.6 in September, 2.9 in October and by a loss of 4.3 per cent in November. This decline in the largest item and in some others cut the increase in total sales to two per cent over a year ago.

Average sales per domestic customer continue to climb and rates to fall. For the twelve-month period the former were 799 kw.-hr., or 9.5 per cent greater than in the like period a year ago; the average rate dropped 6.4 per cent to 4.40 cents and the average monthly bill increased only 2.4 per cent to $2.93.

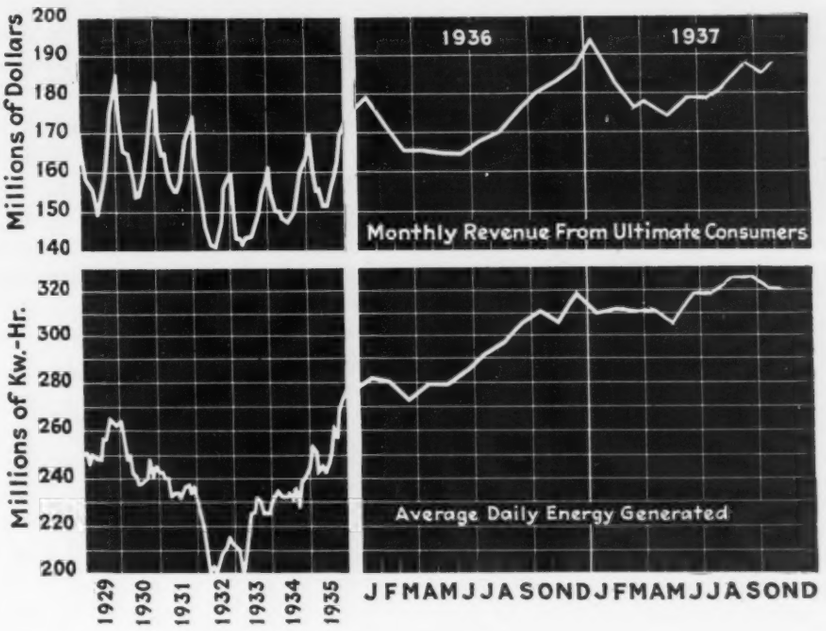


Table I—Monthly Revenue from Ultimate Consumers and Energy Output of the Electric Light and Power Industry

Compared with Corresponding Month of Previous Year

Month 1937	Revenue from Ultimate Consumers‡		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
November	187,296	+3.5	9,315	+ 1.5	3,416	+12.9	5,899	− 4.1
October	186,456	+5.1	9,910	+ 3.3	3,086	+ 0.1	6,824	+ 4.8
September	186,847	+6.4	9,754	+ 6.4	2,947	+ 7.5	6,807	+ 5.9
August	182,057	+7.3	10,099	+10.2	3,028	+10.3	7,071	+10.3

* By courtesy of Federal Power Commission, with deductions for certain plants not considered electric light and power enterprises. ‡ Edison Electric Institute.

Table II—Allocation of Energy by Classes of Service, 1937

Compared with Corresponding Month of Previous Year (Edison Electric Institute)

Class of Service	November		October		September	
	Millions of Kw.-Hr.	Per Cent Inc.	Millions of Kw.-Hr.	Per Cent Inc.	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution*	9,536	+ 2.6	10,123	+ 4.8	9,983	+ 7.8
Lost in transmission, etc.	1,368	+ 6.7	1,615	− 0.1	1,278	− 5.5
Sold to ultimate consumers	8,167	+ 2.0	8,508	+ 5.7	8,705	+10.0
Domestic	1,614	+12.1	1,520	+12.5	1,478	+17.2
Com'l, small light and power	1,600	+13.5	1,552	+13.2	1,586	+13.1
Com'l, large light and power	4,201	− 4.3	4,712	+ 2.9	4,977	+ 9.6
Municipal street lighting	199	− 3.4	188	− 4.6	167	−14.9
Railways — street, interurban	370	− 2.3	355	− 1.5	326	− 3.7
Railroads — electrified steam	104	− 4.7	104	− 2.4	97	− 2.1
Municipal and miscellaneous	79	+ 1.2	77	− 3.9	74	+ 0.6

* Generated, purchased from other sources, imported, less energy used in railway and other departments.

Editorials

S. B. WILLIAMS, Editor

What Kind of an Airing Will TVA Get?

TVA is about to be aired. Who will do the airing and what the investigation will cover, however, is still uncertain. Senator George Norris, known as the father of TVA and as an opponent of private utility ownership, would have the Federal Trade Commission investigate the differences between the members of the TVA board and the activities of the power companies affecting the Authority. Representative May, on the other hand, would have the Military Affairs Committee make a searching investigation of the numerous charges that have been made frequently against TVA activities.

It should be obvious that the Norris program would be nothing more than a white washing of TVA, spattering more mud on the utilities, and largely for the purpose of removing from the board its chairman, Dr. Arthur E. Morgan, who has consistently insisted on fair play and unprejudiced action. The proposal of Mr. May is definitely one of determining the facts regarding TVA, either proving or disproving the charges against the Authority so that the public may know the facts and so that any abuses that might exist can be corrected.

The Administration has repeatedly insisted that business that is fairly conducted need not fear investigation. Is it willing to take some of its own medicine? Now that the legal status of the Authority has been determined, a broad investigation by an impartial committee is necessary to remove any possible stigma against this government power agency so that the millions invested in the project may be utilized productively, and in addition so that there may be assurance that further expenditures of public funds for new undertakings in this project at this time is fully warranted.

On the other hand, if the investigation is not truly to determine the merits, acts and policy of TVA, it would be much better to abandon it than to engage in the spectacle of a mud-slinging, character-besmirching trial where judge, jury and prosecutor are one and the same.

Demand Proof

UNLESS some unforeseen change in rate philosophy takes place the demand meter is destined to occupy an even larger place than it now does simply because some demands are being obtained by other methods. Despite the added cost of the installation there is the definite gain from metering separately and equitably the two major costs of rendering service to users whose load factors are inherently different and for whom the mere watt-hour meter gives only the consumption aspect of the incurred costs.

Nevertheless there are certain aspects of the billing phase of the demand problem that have left some improvement to be desired. The watt-hour meter carries a continuing unobliterated record that always affords the chance to go back and satisfy the customer that imagined discrepancies can be explained away by the facts. The garden variety of demand meter, when the demand pointer is reset, washes out the reading of the last period and starts afresh on the ensuing one. That comes about because demand is an integrated semi-instantaneous indication, whereas kilowatt-hours are inherently cumulative in nature.

One logical means of converting demand registration to a plane comparable to cumulative watt-hours is thus to place a cumulative set of dials on the demand element of the metering installation. At the urge of W. C. Wagner all the meter manufacturers have provided such an adjunct and he reports in this issue that it is working out well. The Philadelphia Company gave adequate consideration to alternative ways of attaining wholly satisfactory billing relations with demand customers, but discarded, among others, the practice of photographing the meter indications for the billing record. Possibly some one can still demonstrate that a photographic record is comparably economical and effective in satisfying the user that the recorded demand was indisputably what the meter reader found it to be and the bill subsequently said it was.

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New Aspect to Diesel Competition

ANNOUNCEMENT last week by General Motors that it was entering the small, low-weight Diesel field in a big way caused many utility commercial men to give thoughtful consideration to the prospects for intensive competition from this direction. Diesel competition is not new, but the mere fact that the largest merchandising organization in the United States has decided to enter this field presupposes two things: One,

that the company had made an exhaustive study of the potential of the market and had found it attractive, and, two, that it was a market susceptible to a merchandising attack through an extensive dealer organization.

Under such circumstances the power companies are bound to meet a new order of Diesel competition. Nor will it be easy, because it will spring up in more places. So far it has not been difficult to meet a case of competitive power where the utility knew about the situation in time. With a wide-flung organization merchandising Diesels it is going to be much more difficult to know about each individual situation in time.

Strictly on the basis of fuel oil cost versus utility rate, the Diesel can put up an attractive picture to a prospect. It is essential, therefore, that customers be shown what constitutes cost and service. There is nothing in the way of competitive power that can be as economical for the customer as central station service. The customer, however, is not fully cognizant of all of the factors involved and until he is he can be easily misled by sales presentations that ignore all of the elements of cost and service.

A year ago a national power advertising program was proposed to acquaint the customers with the full significance of central station service. With this new element in the competitive field such a publicity program becomes more important than ever. The time to lock the barn door is before the horse is stolen.

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Fuse Standardization in Process

THERE is very definite function for fuses to perform on power systems and they have steadily developed in the direction of greater usefulness as conditions demanded progress. Those conditions all center on maximum reliability of service to the utility's customers. Apparatus must be protected against lightning and against internal faults and external faults that would cause damage. But this protective gain must be obtained with the sustained interruption of only as small a section of served area as possible so that customer contentment will not be ruffled. The repeater-reclosing functions are a big step in that direction, but there still is left the question of optimum correlation of current-time speeds and characteristics of a whole gamut of graduated sizes of fuse links.

At the moment, the fuse manufacturers are discussing the standardization of fuses and the dominant unsettled question seems to be whether to provide a single series of ratings rather than to include some of the fast and slow types which have been encouraged by some utility users. In publishing the current article by Mr. Brooke, ELECTRICAL WORLD believes that the one manufacturer's considerations there expressed are typical of what every manufacturer confronts when he is called upon to provide almost any technical product in various sizes and performance characteristics. It is the hope, therefore, that this presentation will be helpful in reconciling the needs of users and makers wherever they differ.

Certainly there is no question that utility engineers want the current-time ratings of fuses clarified as soon as possible and it should be helpful to them to see what a manufacturer is up against when he tries to satisfy the odd requirements stipulated by some users as well as those that have been advanced toward some unity by utility committee discussions.

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"I Refuse to Pay a Bribe"

A FEW days ago citizens of Miami, Fla., opening their daily newspapers were startled to read page-length advertisements with the heading "I Refuse to Pay a Bribe." Even more startling was the fact that the signature to the advertisement was that of Bryan C. Hanks, president of Florida Power & Light Company.

Moving with unprecedented speed, a grand jury has already returned indictments against the mayor, two city commissioners of Miami and their "rate expert" for seeking a pay-off of $150,000 to vote for and ratify an agreement already reached to adjust a pending rate case.

In these troublous days, when politicians of high and low estate are so prone to vilify utility companies and ride them as a hobby-horse for a splurge into public office, the courage of this local president of a local utility company is indeed refreshing.

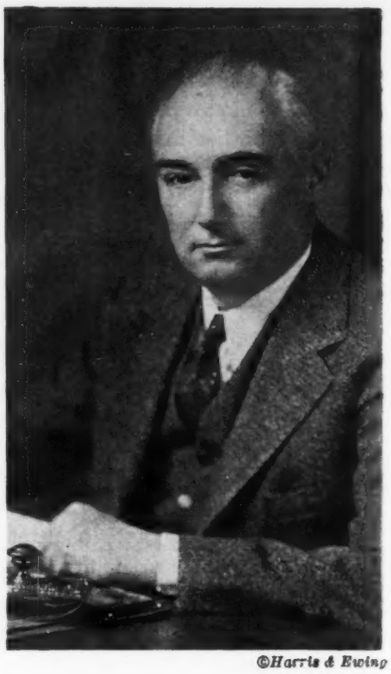
In our opinion, Mr. Hanks has rendered a great service to the people of Miami in exposing the barriers to reasonable rates which may be introduced by self-styled servants of the people. At the same time Mr. Hanks has rendered a great service to the executives and general forces of operating companies all over the United States in pointing out a most practical and effective way of dealing with the political racketeer who spouts about exorbitant utility rates one minute and the next is demanding a bribe from the local company as his price for permitting a logical and fair settlement of a utility controversy to be carried to a satisfactory conclusion.

This Miami "incident" will bring a new wave of encouragement to the men and women of the public utility industry for it reinvests the words "public service company" with their proper significance.

Willkie Proposal Strips Camouflage

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him



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ORCHIDS to Wendell L. Willkie! In fact, the president of the Commonwealth & Southern is entitled to a shower, in which every utility official and security holder in America should participate. Meanwhile, as a result of his suggestion that the United States government buy all the privately owned utility plants in the TVA territory, and, even more important, of his suggestion of the machinery for determining the price, he is being applauded from one end of the country to the other by a lot of other folks.

People who don't believe in government ownership. People who believe the government wastes the people's money every time it does a job which really should have some one running it who would lose his shirt if it failed. Some one not only watching the costs, but compelled to be sure all the time that the customers really want what he is dishing out!

The beauty of Willkie's suggestion is that it compels straight thinking. It strips away the camouflage. Win, lose or draw, the net result will be that even the average radio listener, whose mental age is computed very low indeed by some spending their money for radio advertising, will begin to suspect that all is not gold that glitters, even when it has the New Deal brand.

Here in Washington among the New Dealers, among the middle of the roaders and among the Democrats who go along with the White House for political reasons, nobody likes the Willkie proposal. Yet it is exceedingly difficult for them to criticise it! Which makes a very unpalatable combination. Perhaps the best illustration is a word that most of the copy readers put on the newspaper stories of David E. Lilienthal's answer to Willkie. It was the ace government ownership and yardstick advocate's word "radical" which the headline writers picked. And even to those who agree with Lilienthal it is just a little bit amusing for him to attack something because it is "radical."

If Mr. Willkie had not been unkind enough to propose a board, or rather how the board should be selected, which would determine the price to be paid the owners of the utilities by the government, he would have invited a barrage of criticism. There would have been lots of talk about asking the government to pay for "water" and "air," plenty of speeches by the Norrises and Rankins about Wall street financing, etc.

But the head of Commonwealth & Southern has apparently learned something about Washington, about the New Deal and about politics during his long controversy with TVA. So he went at this problem, fortunately, not as a shrewd business man, but as a molder of public opinion, with far more thought to the public reaction to what he was doing than to whether it was smart business or not. In fact, there should have been, and probably was, a sympathetic gleam of appreciation in the eye of Franklin D. Roosevelt when he read it! And why not? Roosevelt has certainly given Willkie a lot of training!

For it is very hard for a radical to criticise the idea of a board composed of three men, one to be appointed by the company, one by President Roosevelt and the third by the Supreme Court! Especially now that the high bench has a liberal majority. And especially as Hugo L. Black, for years chief anti-utility witch burner of them all, is one of the nine old men. Remember Black? He's the fellow so anxious to get something on the utilities that he had his agents read all the private telegrams in and out of Washington during a period of months covering the drive against the utility holding company death sentence.

Actually, of course, this sort of thing is not what the more rabid utility baiters want at all. The frankest of them, John Rankin of Mississippi, has frankly expressed his idea of the price which should be paid any privately owned utility when the government takes it over: Second-hand value for physical property, nothing for good will, nothing for franchises, nothing for the brains and shrewd management which may have entered into it.

Rankin and Norris know perfectly well that the board appointed by the Willkie formula would be more liberal than that. So they don't like it. But to say openly that they disapprove the idea, are sure that they would not agree with the findings of such a board—that is just a little dangerous. The Willkie idea sounds very fair to the country, even to government ownership advocates. In fact, it sounds to many of them as though Willkie were giving away his shirt in advance, in which precise point lies its chief merit.

It was not the proposal one business man would make to another. It

[*Continued on page 95*]

News OF THE WEEK

Validity of Entire Power Program of TVA Upheld by Federal Court

Unanimous decision rules that government has right to sell power in competition with utilities — Finds Authority not exceeding statutory powers — Power companies plan appeal to Supreme Court

Unanimous decision upholding the constitutionality of the Tennessee Valley Authority and its power program was rendered by a three-judge federal court in Chattanooga, Tenn., last week.

The injunction suit by eighteen southeastern utilities which challenged the legality of the TVA act on the grounds that the Authority's power program and its low rates would destroy them, rendering property worthless without just compensation, was dismissed by the court.

Utilities have no immunity

The court ruled that the utilities "have no immunity from lawful competition, even if their business be curtailed or destroyed."

Attorneys for the utilities announced that an immediate appeal will be made to the Supreme Court. Indications are that the appeal could be argued and a decision given before the court adjourns about June 1.

The 8,000-word decision, read by Presiding Judge Florence Allen of the Sixth Circuit Court of Appeals, and concurred in by District Federal Judges John J. Gore and John D. Martin of Tennessee, stated that "since none of the complainants claims to operate under an exclusive franchise, no fraud, malice, coercion or conspiracy exists; since the Authority is not exceeding its statutory powers and since the statute is constitutional, the competition with these complainants is lawful."

The court held that the ruling of the Supreme Court in the Alabama Power cases against PWA power loans and grants squarely applies to the TVA suit. In the PWA cases the court rules that since the utilities did not have exclusive franchises the municipalities could set up competing plants, and that it mattered not where the municipalities got the money for the plants.

Dams held lawful

Discussing the extensive program of the TVA in building power dams, the court ruled that in each instance the waters released would find their way to the Wilson Dam at Muscle Shoals and thereby aid navigation. On this basis the dams of the TVA were constitutional. "They release water to Wilson, and thus aid in the generation of power at Wilson," the court rules. The legality of power production at Wilson was upheld by the Supreme Court in the Ashwander case.

The court ruled:

Each of the dams constructed, in process of construction and proposed for the TVA system, while varying somewhat in use, as hereafter set forth, is a unit of an integrated multiple-purpose project, the system being designed for co-ordinated use of the full benefits of the river along the lines of navigation, flood control, national defense and power development.

Wherever water falls power is created, and one of the express purposes of the TVA statutes is that hydro-electric power so created shall be sold to assist in liquidating the cost of the project. This is in line with the general development of the conservation movement from 1908 to the present, as it relates to streams.

In discussing charges of the utilities in their complaint, the court said:

The bill charges a conspiracy to injure or destroy the complainant's business, to compete unlawfully, to breach the complainants' existing contracts with their customers, to compel and coerce complainants to sell their plants at distress figures.

It charges that the TVA has conspired with and practiced coercion upon municipalities and co-operatives to compel them to set up their own distribution systems for the purpose of selling TVA power at retail.

If the record had substantiated the allegations of the bill, grave questions would have been presented. But these allegations have not been established. . . .

Finds no coercion

Since complainants have not sold, they have not been coerced to sell their properties, and the negotiations for sale presented in this record do not evidence acts deemed coercion under settled legal principles. No malice in law is shown on this record. The motive of officials who execute a law is immaterial, even though accompanied by a wrongful purpose.

Neither has unlawful competition been proved. The attempt to show that the Authority has endeavored to persuade complainants' customers to breach their existing contracts for purchase of power from complainants has totally failed.

In every case where a customer of the complainants has been lost to the Authority, the cause has been no unlawful competition, but the lawful allurement of substantially lower prices. . . .

No fraudulent attempt has been made to secure complainants' markets. Whatever compulsion exists is the inevitable compulsion exercised by the fact that a competitor sells at lower rates than complainants.

But if the operation of the TVA is legal, the complainants have no legal rights not to be subjected to such competition even though it curtail or destroy their business.

The court also held that the statute specifically required that generation of power be incidental to the exercise of constitutional powers. The court also held that the sale of power by TVA was a government function of disposing of its property, was lawful and is not entering into private business.

The court further held that "the government has an equal right to sell hydro-electric power, lawfully created, in competition with a private utility. There is no constitutional authority which denies the government the right to seek a wider market and the transmission and distribution lines erected are a proper facility for conveying the property of the United States to the market."

Political Uncertainty Is Hindering Expansion of Capital, A.I.E.E. Told

Head of Brookings Institution sees economic activity hinging on clearing of political skies in address at winter convention of A. I. E. E. in New York — Gano Dunn awarded Edison Medal

If the political skies could be cleared and agreements be reached with respect to a few major issues now confronting business and the government the foundations would be laid for a period of remarkable economic activity in the rehabilitation and in the expansion of new capital and durable consumer goods, declared Dr. H. G. Moulton, president the Brookings Institution, Washington, D. C., this week.

Speaking Wednesday morning at the general session of the winter convention of the American Institute of Electrical Engineers in New York City, Dr. Moulton said that in view of the uncertainty shrouding the immediate outlook confident prediction with respect even to the next few months was unwarranted. Early last April Dr. Moulton forecast the present business recession and discussed its contributing factors.

While Dr. Moulton believed that recovery in the consumer industries might be brought about by such factors as the working off of excess inventories and the decline in prices of raw materials, stimulated, perhaps, by government spending. He declared that expansion in capital enterprise depended on "the re-establishment of confidence with respect to the future of the capitalistic system."

"If there seems to be a real possibility that we are to embark upon a new and intensified program of governmental regulation and control, the objectives of which appear ill-defined and contradictory, we cannot expect the risks of expanding enterprise to be assumed either by business enterprisers in quest of profits or by individual investors looking for safe investments," Dr. Moulton held.

Preceding Dr. Moulton's address, the Alfred Noble Prize was awarded to Dr. G. M. L. Sommerman, research engineer American Steel & Wire Company, Worcester, Mass., by Dr. Robert Ridgway, past-president of the American Society of Civil Engineers. The award, given each year for the best technical paper presented by a member of one of the four founder engineering societies, has been made for six years; Dr. Sommerman is the third electrical engineer to receive the award.

The A.I.E.E. Edison Medal for 1937 was awarded Wednesday evening to Gano Dunn, president J. G. White Engineering Company, New York, N. Y., "for distinguished contributions in extending the science and art of electrical engineering, in the administration of great engineering works and for inspiring leadership in the profession." Following the presentation, Stephen F. Voorhees, senior partner of Voorhees, Gmelin & Walker, delivered an illustrated lecture on the New York World's Fair of 1939.

Inspection Trip

Aside from the general session, the Edison Medal presentation and sixteen technical conferences, five conferences were held during the convention week, at which the speakers informally discussed education, radiation fields, sound and vibration measurements, linear networks and definitions. At the conference on sound and vibration measurements the discussion centered around developments of standards of measurements.

Prominent among the inspection trips scheduled for the week were those to view the recent modernization of the Waterside generating station of Consolidated Edison Company of New York, Inc., to the Okonite-Callender Cable Company, Paterson, N. J., and

A.I.E.E. OPENS CONVENTION—Among the electrical engineers attending the first day's sessions of the winter convention of the American Institute of Electrical Engineers in New York City this week were these: Top center, left to right—Mark Eldredge, Memphis Power & Light, and I. Melville Stein, Leeds & Northrup. Bottom, left to right—Charles Gordon, American Transit Association; S. B. Cooper, Westinghouse Electric & Manufacturing; C. M. Davis, General Electric; Thomas Fitzgerald, Pittsburgh Railways, and G. I. Wright, Westinghouse, all of whom spoke at the opening session of a symposium on modern electric vehicles, at which Mr. Wright presided. Bottom, right, l. to r.—C. R. Jones, Westinghouse; T. E. Barton, General Electric, and I. E. Moultrop, Boston Edison

to Westinghouse Electric & Manufacturing Company's meter works at Newark, N. J.

Attendance at the convention appeared to break previous records, as an attendance of more than 1,000 was reported through the second day, which was well ahead of last year's gathering.

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Pacific Gas Plans $15,000,000 Issue

Pacific Gas & Electric Company has filed with the California Railroad Commission an application for authority to issue $15,000,000 par value of its first and refunding mortgage, series I, 3½ per cent bonds, maturing June 1, 1966. This is the first time in six years that the company has entered the market for new capital. In the intervening period the company's fixed charges have been reduced by a series of bond refunding operations, culminating with the sale in 1935 and 1936 of an aggregate of $250,000,000 first and refunding mortgage bonds, bearing coupons of 4 per cent, 3¾ per cent and 3½ per cent.

The purpose of the new issue, according to J. B. Black, president, is to replenish working capital and provide additional funds for construction purposes.

Preliminary estimates indicate that the company's gross expenditures for additions and betterments to its properties during 1938 will be in excess of the $21,000,000 spent for this purpose in 1937, and will involve the largest outlay in any year since 1931.

Major items in the construction budget include the completion of work now in progress at Station C, Oakland, which will add 54,000 kw. of steam-electric generating capacity at a cost of approximately $5,250,000; and the installation of two additional 44,000 kw. steam-electric plants, each costing approximately $5,000,000, at the Avon and Martinez plants, respectively, of the Tidewater-Associated and Shell Oil companies.

In addition, there are a large number of additions to transmission and distribution facilities under way or provided for, involving in the aggregate the expenditure of several millions of dollars.

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Plans Plant Improvements

Decatur (Ind.) light and power plant is planning a $12,000 to $15,000 improvement program to the distribution system, to take care of the growing needs of consumers in both the residential and business sections.

Civil Engineers Talk Power Costs at Annual Convention in New York

Page asks for calm approach to power question and Mead terms "yardstick" plants "fantastic" as utility, consulting and federal engineers discuss relative costs of steam- and hydro-generated energy

A calm consideration by engineers of the power question was asked by John C. Page, commissioner U. S. Bureau of Reclamation, at the symposium on power costs during the annual convention of the American Society of Civil Engineers, held last week in New York City.

In his paper, read in his absence by L. N. McClellan, chief electrical engineer with the bureau at Denver, Colo., Mr. Page asked: "If the profession accepts, as I believe it must, the idea that such projects as Bonneville, Boulder, Grand Coulee, Shasta and other dams must be built, has not the time come for the engineering profession to approach them calmly so as to appraise their benefits soundly as power and as conservation projects?"

Mead attacks "yardsticks"

The so-called "yardstick" plants were sharply criticised by Daniel W. Mead, past-president of the society and a consulting engineer in Madison, Wis., who characterized them as "purely fantastic and actually meaningless except to the man who assumes that the cost of power plants and of power generation is simple, and of such uniform and constant character under all circumstances that a criterion can easily be established."

U. S. attorneys in the TVA case stated that the federal government can, if Congress so directs, furnish power for nothing, Mr. Mead said. "This is doubtless so, but in so doing they can scarcely expect engineers, or even the public, to accept such prices as a fair and honest 'yardstick' for public utility prices," he continued.

Mr. Mead declared that it was impossible to establish a fair and just measurement of what power will cost or the fair and equitable price at which it should be reasonably sold except by considering the individual circumstances of construction and operation.

Continued improvements in the economic performance of plants generating energy from fuel were seen by Dr. C. F. Hirshfeld, chief of research, and R. M. Van Dusen, research department, Detroit Edison Company, who said: "Half the present fuel consumption per unit of output with no increase in fixed charges per unit of capacity is the present prospect for the not-too-distant future."

Survey of hydro plants

Cost and other supporting data, as obtained for 57 hydro plants, from both the federal government and utilities were presented by Prof. H. K. Barrows, Massachusetts Institute of Technology. Fifteen of these plants are in the East, fifteen in the Central and Southern states and 27 in the West; with one exception, they have been built since 1920. Individual plants vary over the following ranges:

Plant capacity, kw.	400 to 252,000
Head, ft.	12 to 2,561
Yearly output, million kw.-hr.	1.5 to 1,300
P'ant cost	$91,000 to $50,450,000
Cost per kw. of capacity	$95 to $479
Cost per kw.-hr., cents	0.16 to 3.74

The 57 plants have a total capacity of about 2,250,000 kw.; they cost about $385,000,000, or an average of $171 per kw. Their total output is about 9.5 billion kw.-hr., about one-fourth of the total U. S. public utility hydro output for 1936, at an average cost of 0.44 cent per kilowatt-hour.

With costs adjusted to an approximate capacity factor of 0.5, costs per kilowatt-hour range as follows:

Head, Ft.	Cost per Kw.-Hr., Cents
Under 100	0.2 to 1.2
100-500	0.3 to 1.1
Over 500	0.25 to 0.55

Operation and maintenance costs added only slightly to hydro power costs.

A study on the financial operation of the Grand Coulee project indicated that the cost of firm energy delivered at the high-voltage bus at Grand Coulee power plant will be 2.25 mills per kilowatt-hour if repayment of the cost of the irrigation development to the extent of about $243,000,000 is included in the power rate base, said L. N. McClellan, in the discussion of Professor Barrows' paper.

Whitman criticises TVA

Ezra B. Whitman, consulting engineer of Baltimore, Md., held that no private company would have undertaken the TVA development without having first made studies as to how the power could be absorbed by the available market, in the same way

that studies were made in connection with the Conowingo plant of the Philadelphia Electric Company.

Mr. Whitman, a former member of the Maryland Public Service Commission, expressed the belief that if the government and private utilities would sit down together and work out a plan for the economical utilization of their combined power plants it would be possible to serve the territory not only to the advantage of the customers, but also in such a way that the investments of the private companies would not be destroyed. However, he said that if TVA should take from the private companies such cities as Knoxville, Chattanooga, Nashville, Memphis and Birmingham, a great majority of the private plants now serving these communities would be rendered useless and the investments of security holders in these companies would be destroyed.

Maurice R. Scharff, consulting engineer, New York, N. Y., advocated an engineering study of the causes of depreciation and of methods of measuring their effects, suggesting that progress in this direction might bring utility finance and regulatory practices into harmony with the facts regarding depreciation, instead of continuing to depend on financial and political policies.

The symposium on power costs, which occupied an entire day's session, was a continuation of a policy started in 1936 at the society's meeting in Pittsburgh, but was devoted to bring out factual data. It is planned to take up power transmission and distribution costs at a future time in a third symposium.

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Street Lighting Resumed

After being "in the dark" for the past two years, South Lebanon, Ohio, now enjoys street lighting once again, following the signing of a five-year contract with the Cincinnati Gas & Electric Company and the town council. Lights were turned off in July, 1936, when the village was unable to pay a bill of $721. Although the utility offered a year's free service, the village began to liquidate the debt, which has now been paid. Passage of a 3-mill levy last November aided.

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League to Issue Directory

The Rocky Mountain League, Denver, Colo., plans to issue a directory covering the electrical industry of this region. It will include all towns and cities served by both private and municipal systems and names of all major and local managers.

Power Salesmen Talk on Selling Methods

Selling methods, routines, records and techniques, with due attention to sales psychology, set the tone for the Power Sales Conference of the Missouri Valley Electric Association at Kansas City last week.

Air conditioning, isolated plant competition, irrigation pumping, Diesel engines and other subjects classic for discussion by power salesmen figured prominently on the program. Under the direction of Ford Bates, chairman of the committee, discussion of these concrete matters was allowed to dwell less on engineering aspects and details and was turned more to their consideration as selling problems.

"Selling Air Conditioning at a Profit" was presented by John Meaders and G. A. Coleman, covering a comprehensive study of the problems met and solved in the promotion and sale of air conditioning in Tulsa, Okla., covering sales methods, consultation services, co-operation with contractors and dealers, market analysis and selective selling.

Discussion of sales methods in meeting isolated plant competition was led by George H. Weckel, who presented an organized analysis of methods and tactics for meeting such competition. W. H. Stueve presented a breakdown of Diesel engine sales statistics which showed the extent to which these sales represent competition with purchased power. The art of salesmanship as it is employed—or rather as it should be employed—in selling power was discussed by H. F. Hemker. Systematized selling routines, records, forms, files, reports were explained to the meeting by F. A. Graham. H. E. Roberts presented a report on typical loads secured in the past year by the companies in the Missouri Valley area.

W. R. McGeachin described the propaganda methods used by REA and other government agencies in promoting irrigation pumping in eastern Nebraska as an outlet for excess hydro capacity. While this method of irrigation has real value in the western part of the state, where rainfall is light, its merit is problematical, it is said, in sections where apparently the greatest propaganda effort is being put on it.

New officers selected and proposed for appointment were W. H. Stueve, chairman, and G. H. Weckel, vice-chairman.

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Air Unit Installations Up

Air-conditioning installations in Birmingham, Ala., in 1937 showed a tremendous increase in the number and size over the preceding year, according to a compilation made by Harold V. Fried, air-conditioning engineer, Birmingham Electric Company. There were 61 installations with a total of 1,655 hp. for 1937, as compared with 44 installations with only 594 hp. the preceding year. For 1938 it is estimated that $200,000 worth of air conditioning and $40,000 worth of ventilating equipment will be sold.

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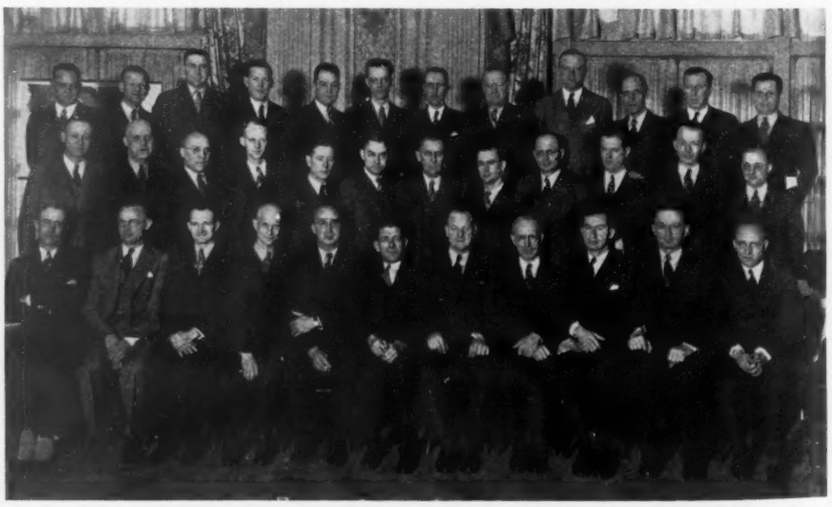
Exempted From Sales Levy

The Missouri Supreme Court *en banc* has ruled that sales of electricity for use in street railway systems or for municipally owned water pumping stations are not subject to the state sales tax of 2 per cent.



SALES CONFERENCE—Important problems of power salesmen were discussed at the power sales conference of the Missouri Valley Electric Association held last week at Kansas City

Michigan Farmers Get Benefits in Rural Electrification Race

More than 50% of farms in state now receive electric service — Total number of farms served has increased in last ten years from 11,600 to estimated 82,500 — REA program target of Farm Bureau

Michigan farmers may have lots of things to worry about, but they can chalk electricity way down the list if reports of rural electrification in the state are to be taken as a criteria.

Extension of rural electric lines by private utilities over a period of years was a constant job well done long before REA came into being. Since the birth of that government agency a great deal more attention has been paid to this phase of utility service.

82,500 farms now served

The extent to which rural electrification has been accomplished is seen in the fact that in 1927 only 11,600 of Michigan farms were served. By 1934 the total had hit 42,152, by 1935 it climbed to 50,876, to be upped to 63,729 by 1936. Last year it is estimated that 18,771 more farms were added to power lines, to bring the total for the state to 82,500, or about one-half of all farms.

So well have the private utilities electrified Michigan farm areas that REA has been forced to use its best talents to drive a wedge. The situation has developed into a "race," with a lot of side battles to make it highly interesting.

Clark L. Brody, secretary-manager of the Michigan State Farm Bureau, has criticized the REA for its policy of ignoring the major farm organizations in attempting to put over its rural electrification program. He said his organization was forced to oppose the REA bill in the 1937 Legislature because it was unable to get "jokers" removed from it. Mr. Brody charged the bill sought to "make a racket of rural electrification in Michigan."

Waited in vain

For two years the Farm Bureau waited in vain for an invitation from the REA to confer on rural electrification, then last November it drafted a resolution inviting the REA to confer with it.

Unlike the REA, Mr. Brody asserts, the private utilities have counseled with farm organizations in rural programs. As a result, he said, "half of the farmers today have electricity."

Dan E. Karn, vice-president and general manager of Consumers Power Company, reports that its mileage of rural electric lines was increased more than 50 per cent in 1937. During the year 3,683 miles of new line were built, boosting the company's mileage to 10,739. This rural construction was not only the greatest in the company's history, Mr. Karn said, but probably the most extensive program of its kind ever carried out in the United States or elsewhere.

New rural customers connected to the company's lines numbered 19,613, of whom 14,607 were farmers. They increased the total rural customers to more than 80,000, of whom 41,307 were farmers.

Mr. Karn reports that slightly more than 50 per cent of all farms in Consumers Power territory, which includes much sparsely settled country, now are receiving electric service. The company plans to continue a vigorous extension program this year.

Electric use higher

H. J. Gallagher, farm service supervisor for Consumers Power, reports that the average use of electricity by farmers rose sharply during last year; the average use was 1,079 kw.-hr., as against 923 in 1936 and 750 in 1935.

Greater use of electricity, Mr. Gallagher points out, has brought even lower rates to Michigan farmers. In 1936 the average rate paid by Consumers Power farm customers was 3.77 cents per kw.-hr. In 1936 it dropped to 3.35 cents, and in 1937 it was 3.15 cents. Mr. Gallagher said this rate ranked among the lowest in the country.

With rural electrification progressing so rapidly steps have been taken to portion the territory. The Farm Bureau has approved in principle the idea of permitting the Public Utilities Commission to determine the areas which should be served by private power company and which areas would be awarded to REA.

REA is having its troubles with farm organizations. The Michigan Farmer says: "Our progress (in getting farm electricity) has come through co-operation of farm organizations, Michigan State College, past public utility commissions and existing public utilities serving in the state. If it is the intent of the REA to disturb this co-operation and seriously interrupt this progress toward the goal . . . then we question its value to Michigan agriculture."

Charges have been made that REA seems to be "balling up" Michigan's excellent record of getting electricity to the farmers. It is said that trouble started when REA invaded the field.

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Standard Gas Budget Totals $31,392,873

Preliminary construction budget for Standard Gas & Electric Company for this year will total $31,392,873 for operating companies in the system, not including the California Oregon Power Company and the Mountain States Power Company, budgets for which have not yet been approved by the respective boards of directors, according to Bernard W. Lynch, president.

Mr. Lynch stated that the preliminary construction budgets for the individual operating companies in the system are indicated as follows:

Louisville Gas & Electric	$2,447,767
Market Street Railway Co.	578,607
Northern States Power Co. (Minn.) and subsidiaries	6,810,740
Northern States Power Company (Wis.) and subsidiaries	918,925
Oklahoma Gas & Electric	2,861,257
Philadelphia Company	12,543,598
San Diego Consolidated Gas & Electric	1,572,016
Southern Colorado Power	221,714
Wisconsin Public Service	3,310,699
Empresa De Servicios Publicos De Los Estados Mexicanos, South America	127,550

The amount of $12,543,598 indicated as the preliminary construction budget for Philadelphia Company includes expenditures contemplated by all of the subsidiaries of the company, Mr. Lynch said. Included in this amount are estimated expenditures by Duquesne Light Company of $8,276,690 and Equitable Gas Company of $1,134,300.

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Demands Utilities to Show Part of Financial Records

Arkansas Utilities Commission has announced that the commission henceforth would require utility companies to reveal parts of their financial records needed by municipalities desiring to purchase the utility properties, providing information sought by a city was set out definitely in a petition to the commission after a city council had voted to attempt the purchase.

The statement of policy was made by Chairman Thomas Fitzhugh during a discussion between representatives of the city of Texarkana, Ark., representatives of the Texarkana Water Corporation and commission members on the corporation's refusal to reveal its

records to representatives of the city, which is considering purchasing the water system.

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May Pushes Inquiry of TVA Operations

While TVA was rejoicing over winning a court decision against eighteen utilities, trouble on other fronts broke out. A sweeping investigation of its operations and the trouble among its directors appears a certainty.

The resolution by Senator George W. Norris directing the Federal Trade Commission to make an inquiry into the operations of TVA was favorably reported by the committee on agriculture and forestry, although the authorized appropriation was cut from $200,000 to $100,000.

Representative Andrew J. May, chairman of the House military affairs committee, which has jurisdiction over TVA, sent a private memorandum to forty to fifty Senators urging them to kill the $112,000,000 Gilbertsville Dam project. Mr. May said it was a "useless expenditure" for "a wasteful and unnecessary project."

Unified control of water resources through creation of regional agencies limited in function to planning and regulation only is preferred by Dr. Arthur E. Morgan, TVA chairman, to others proposed in the 7-TVA bills. Mr. Morgan's views were made public last week with the release of a written statement submitted by him to the House committee on rivers and harbors, which has been holding hearings on the regional planning and power authority bills.

"The part which water-power development will play in unified river control is greatly exaggerated in the public mind," Mr. Morgan said. "It is unfortunate that water power has become an obsession with some men, since that attitude may be a handicap to the enactment of legislation for unified river control."

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Files Hydro Application

Announcement has been made by the Electricity Board of the Province of Quebec that the St. Maurice Power Corporation, which is jointly owned by Shawinigan Water & Power Company and the Brown Corporation, has made application to the board for permission to proceed with construction of a hydro-electric power plant on the St. Maurice River at La Tuque, Que. Estimated cost of this undertaking, with an installed capacity of 162,000 hp., is $12,500,000.

BERNARD F. HOWARD receiving from Earle S. Thompson, president of American Water Works & Electric Company, the National Safety Council President's Medal for saving the life of a boy from drowning through use of the prone-pressure method. The presentation was made during a recent meeting of West Penn Power employees, at which the company's program for the year was made known

California Edison to Spend $26,000,000

Southern California Edison Company will be instrumental in the distribution of approximately $26,000,000 in its territory during 1938 in new construction, operation and maintenance, taxes and payrolls, according to Harry J. Bauer, president. This compares with the expenditure during 1937 of approximately $22,000,000.

Funds of the 1938 budget for payroll, operations and maintenance and new construction, totaling approximately $18,500,000, will be expended according to requirements in the eleven divisions comprising Southern California Edison Company territory in southern and central California.

This new construction will include completion of facilities for bringing Boulder Dam power into the Edison system. The construction of a 230-mile, 230,000-volt steel tower transmission line from the dam to the company's Chino receiving station is well under way. Expenditure of approximately $600,000 for completion of the transmission line and $1,130,000 for the extension of the Chino station is planned.

The company plans an expenditure of approximately $1,000,000 for new transmission lines, other than the Boulder Dam line, and preliminary work in connection with the construction of a new major switching station. Construction of new distribution substations is proposed for the company's Santa Monica and Huntington Park districts to cost approximately $103,000 and $185,000, respectively. Additions to existing distribution substations in the Santa Barbara and Pasadena districts totaling $325,000 also are contemplated.

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New England States Ask Pact Approval

Approval by Congress without further delay of the compact ratified by the New England states in the matter of flood control on the Connecticut and Merrimac rivers was urged in a resolution adopted by delegates to the 33d annual convention of the National Rivers and Harbors Congress held in Washington last week.

Another resolution urged a thorough Congressional investigation of TVA. "Pending the completion and disclosure of such Congressional investigation," the resolution reads, "we recommend that Congress give no consideration to any authority, original or planning agencies similar to TVA."

Legislation excluding flood control reservoirs from any control by the Federal Power Commission was recommended in another resolution.

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Memphis Awards Contract for Power Substations

City Light and Water Department, Memphis, Tenn., has awarded a contract to the A. E. Koeneman Electric Company, St. Louis, Mo., for two power substations and equipment, to be known as substations C and F, respectively, at a lump sum price of $508,972. General Electric Company equipment is specified by the contractor, including 4-kv. indoor switchgear and feeder regulators, bench-type control switchboard, cables, circuits and complete primary and auxiliary equipment. One station will be located at Third and St. Paul Streets and the other on Willet Street, both to be connected with TVA power lines for local distributing system.

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Farm Equipment Business Up

Business of Allis-Chalmers Manufacturing Company in its farm equipment division in the last three months of 1937 ran ahead of that done in the similar period of 1936, according to General Otto H. Falk, chairman. Other divisions showed a falling off in line with general business.

Utilities Seen as Key Log in Business Jam

There is a moral responsibility on the part of President Roosevelt and Congress to protect the savings of investors in public utilities and also to make it possible for new investors to furnish the money to restore business confidence and increase employment, S. B. Williams, editor of ELECTRICAL WORLD, told members of the Engineers' Club at Charlotte, N. C., this week.

"This is a responsibility which cannot be escaped," he said.

Describing the power utility industry as the key log in the present business jam, Mr. Williams declared that "if that key log can be shaken loose from the jam business will be revived. The key log, however, cannot be shaken loose unless the investor is encouraged to put money into utility properties. It is now entirely up to government to give that reassurance. It is clearly up to government to state a policy that is contrary to the one stated by Assistant Attorney-General Robert H. Jackson."

Mr. Williams was referring to the statement of Mr. Jackson following the debate with Wendell L. Willkie, Commonwealth & Southern president, in which he said, in answer to a question from the audience, that "I don't think the question of fairness entered into it," in the government's competition with the utilities.

The present attack on the utilities by the government was considered unfair by Mr. Williams: "The present attack goes far beyond the holding companies. What has happened to the utilities can just as easily happen to other forms of business. Are we now on the threshold of government ownership of business? Are we to go the way of Italy and Germany? It is a tremendous responsibility, but an easy decision to make if the commercial integrity of the country and freedom of private initiative and of property is to be preserved."

Mr. Williams said that business will feel free to go ahead when it knows what Washington is going to do. He said that it was up to Washington to clarify the atmosphere.

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PWA Approves Power Plans

Plans and specifications for two public power projects estimated to cost a total of $215,000 have been approved by the PWA and delivered to Col. Harold C. Fiske, chairman of the Chattanooga Electric Power Board, by Kenneth Markwell, chief PWA project engineer at Chattanooga, with the recommendation that the board proceed with advertising for bids.

The plans, first in a series of forty-odd being prepared in connection with construction of a system estimated to cost $6,500,000, are for a transmission line and for transformers for three substations. Colonel Fiske said that it is hoped that advertising for bids could be started by February 1.

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Will Spend $15,000,000

Officials of the United Light & Power Company system have announced that the company and its subsidiaries would spend an estimated $18,000,000 for construction in 1938. Such expenditures in the first eleven months of 1937 approximated $13,000,000.

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Cost of Florida Plant Set

FPC has fixed the legitimate original cost of the Florida Power Corporation's hydro-electric plant near Tallahassee, Fla., at $2,621,043, disallowing as part of the development cost items totaling $461,710. Among the items disallowed was one for $209,551, which the original sponsor of the project, the West Florida Power Company, claimed it paid to the Florida Power Corporation for supervisory services during construction. During the hearing in 1935 the utility waived its claim to $99,647 of this sum, leaving in question $109,903.

Willkie Points Out Low Electric Rates

The recent informal report for 1937 of the operations of the Commonwealth & Southern system made by Wendell L. Willkie, president, and published in leading newspapers throughout the territories served, has received much favorable comment as marking a further step in keeping the public informed as to the work of the industry.

In his report Mr. Willkie stated that the city and farm customers of his system pay an average residential rate of 25 per cent below the national average, the average rate being 3.25 cents a kilowatt-hour. He said that this is a lower average residential rate than is obtained in any other utility group in the United States.

During 1937, Mr. Willkie said, net sales of electrical appliances made by the system were about $17,500,000, a new high in appliance sales.

"As a result of these progressive policies," Mr. Willkie said, "the average Commonwealth & Southern home is using 37 per cent more electric service than is being used in the average American home." The average use is 1,100 kw.-hr., one-third higher than the national average.

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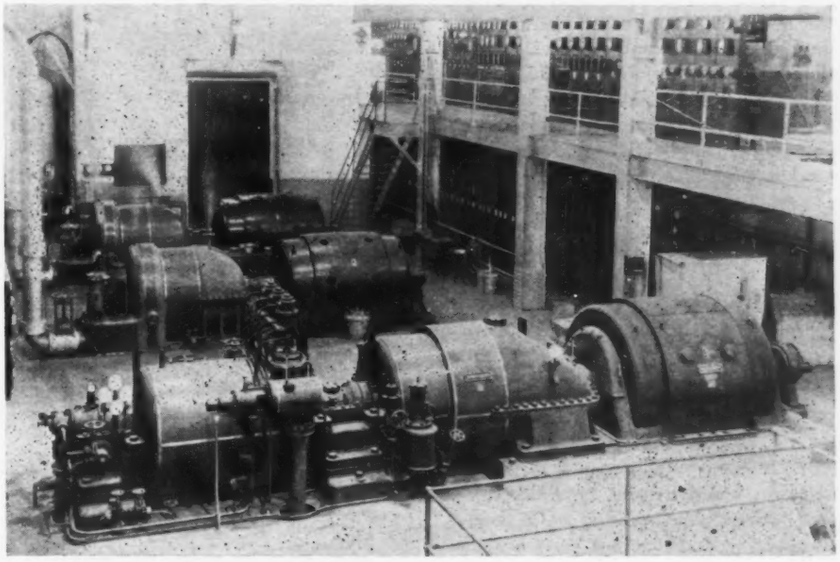
Electrifies 83 Miles More

Electricity replaced steam on January 15 on an 83-mile route of the Pennsylvania Railroad between Paoli, Pa., and Harrisburg. The new link completed the eastern network of electrification which extends to New York City and Washington.



BATHURST STEAM PLANT—Using steam at 650 lb., this new power plant in the Bathurst, N.B., paper mill of Bathurst Power & Paper Company is said to be the highest pressure plant in the Canadian paper industry

Boston Air Bureau Sees Good Business

Anticipation of good business in 1938 and encouragement from the work of the past four years featured the annual meeting of the Boston Air Conditioning Bureau last week. About 200 attended and high tribute was given Julius Daniels, retiring president, for energetic leadership during his administration.

Mr. Daniels is succeeded by Henry R. Sewall, manager of the cooling and air conditioning division, B. F. Sturtevant Company, Boston.

Rudolph Sommers, vice-president Boston Ice Company, was elected vice-president; E. D. Johnson, New England representative Buffalo Forge Company, treasurer, and Daniel Ricker, head of the air conditioning division, Boston Edison Company, was re-elected secretary. New directors are Louis Gardner, General Heat & Appliance Company, and S. T. Smith, Gar Wood Industries, Inc.

Edward Roemer, building commissioner of Boston, congratulated the bureau upon its growth from 25 to 200 members in four years, paying tribute to Mr. Daniels' direction of its affairs. Frank Ewart of the C. W. Whittier organization, Boston, stressed the value of office building air conditioning from the realtor's viewpoint.

The guest of honor was Willis H. Carrier, chairman of the board of the Carrier Corporation, who declared that progress in this field depends primarily on giving real value to the user based on sound engineering and economic analysis.

"The industry must steer away from the price-cutting basis," Mr. Carrier said, "working continually toward reduction of costs and giving the consumer greater value per dollar. Installations often pay for themselves in from three months to three years, but proper application engineering is fundamental." Mr. Carrier pointed out that the present rate of development in this class of service to industry and commerce goes back only six years.

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Birmingham Electric Will Feature Electric Cookery

Advertising and sales promotion of electric cookery will be the main feature of the Birmingham Electric Company's activity during 1938, some 100 dealers were notified at a recent meeting. Estimates set up by the company call for the sale of 1,600 ranges during the year by both dealers and the utility.

Along with the electric range, the electric water heater will be promoted, "as past experience proves that the electric water heater sells best as a companion item to the electric range." For 1938 estimates call for the sale of 350 water heaters.

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Memphis Gets $3,092,000

A $3,092,000 PWA allotment to construct a municipal distribution system in Memphis, Tenn., for TVA power has been released, the PWA announced in Washington. The allotment was made available following the dissolution, by agreement with the Memphis Power & Light Company, of an injunction suit against the government which held up the grant. The city has already issued $3,000,000 in bonds and the PWA allotment will be used to further the project. The government money becomes available immediately, according to PWA officials.

Meetings

Canadian Electric Association—Annual winter conference. Windsor Hotel, Montreal, Que., January 31-February 1.

National Association of Purchasing Agents—Public utility group, tenth annual midwinter meeting. Medinah Club, Chicago, Ill., February 3-4. A. C. Bull, chairman, Public Utility Engineering & Service Corporation, 231 South La Salle St., Chicago.

National Electrical Manufacturers Association—Midwinter meeting. Waldorf-Astoria Hotel, New York, N. Y., February 7-11. W. J. Donald, managing director, 155 East 44th Street, New York.

Edison Electric Institute—Prime movers committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 6-7; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, February 7-8; transmission and distribution committee, Brown Hotel, Louisville, Ky., February 9-10; sales committee, Edgewater Beach Hotel, Chicago, Ill., March 28-31.

American Institute of Mining and Metallurgical Engineers—Annual meeting, February 14-17, New York, N. Y. A. H. Parsons, secretary, 29 West 39th Street, New York.

Midwest Power Conference—La Salle Hotel, Chicago, Ill., April 13-15. L. E. Grinter, Dean, Graduate Division, Armour Institute of Technology, Chicago.

Missouri Association of Public Utilities—Annual convention, Jefferson Hotel, St. Louis, Mo., April 20-22. Jesse Blythe, assistant secretary, Merchants Bank Bldg., Jefferson City, Mo.

Northwest Electric Light and Power Association—Annual meeting, engineering and operation section, Vancouver, B. C., April 20-23.

N.E.M.A. to Honor Five Industry Pioneers

N.E.M.A.'s annual dinner, always a highlight of the midwinter meeting, is to be held February 10 at the Waldorf-Astoria Hotel, New York. Of outstanding interest will be the presentation of certificates of recognition to those members who have completed fifty years of continuous work in the electrical industry. These pioneers include S. B. Condit, Chase-Shawmut Company; E. R. Grier, Arrow-Hart & Hegeman Electric Company; S. L. Nicholson, Westinghouse Electric & Manufacturing Company; J. H. Parker, Union Insulating Company, and E. H. Sniffen, Westinghouse Electric & Manufacturing Company.

At the policies division meeting on February 9 an important election will be held to decide who shall fill the six newly created places on the board of governors. A progress report on the anti-boycott suit filed by N.E.M.A. and fourteen member companies will be given by Walter G. Merritt. T. Y. Williams will speak on the latest developments in the New York labor situation as it affects the electrical industry.

Francis E. Neagle, N.E.M.A. counsel, will outline the current development of various pieces of legislation affecting the industry in a summary entitled "What Are We Going to Do About Proposed Legislation?"

•

Move to Buy Utility Units Made by TVA

The board of directors of the Tennessee Valley Authority this week authorized David E. Lilienthal to conduct negotiations with private utility companies and with municipalities, cooperatives and other public agencies looking toward the possible sale of electric properties by the utilities to the public agencies and to the Authority.

Mr. Lilienthal is also authorized to consult with interested agencies of the federal government in such matters.

Senator George W. Norris announced his intention to introduce an amendment to the TVA act which would authorize the Authority to purchase private utility lines.

•

Ontario Primary Load Up

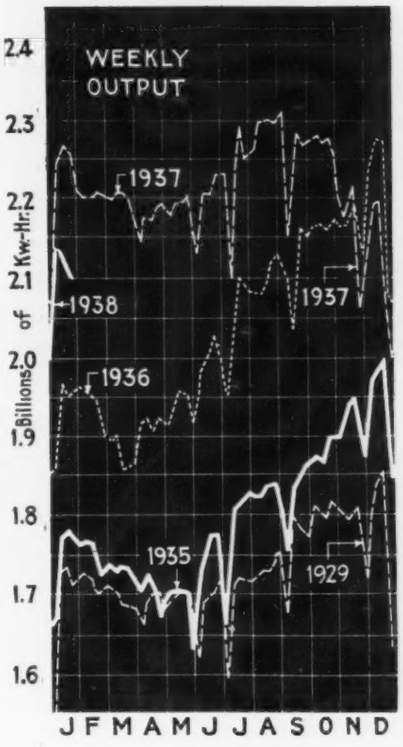
Hydro-Electric Power Commission of Ontario reports primary load of all systems for December at 1,492,614 hp., compared with 1,390,880 in December, 1936, an increase of 7.3 per cent.

Output Continues Under 1937

Production down 6.6 per cent — Recession is greatest in New England and Central area

Holding close to the figure for the preceding week, the output of energy by the electric light and power industry during the week ended January 22 amounted to 2,108,968,000 kw.-hr., according to the Edison Electric Institute. The decrease of 0.3 per cent can scarcely be regarded as significant. The movement was parallel with that registered a year ago and production was again 6.6 per cent less than in 1937. Compared with the like period two years ago there was an increase of 8 per cent.

Regionally considered the recession from operations a year ago was most severe in the Central industrial area, where it has now grown to 12.3 per cent. In New England the output has been under that of a year ago since October, with a present deficiency of 12.1 per cent. All other regions are down with the single exception of the Rocky Mountain.



Per Cent Change from Previous Year

Region	Week Ending Jan. 22	Jan. 15	Jan. 8
New England	—12.0	—12.1	....
Middle Atlantic	— 1.6	— 0.7	....
Central Industrial	—12.3	—11.3	....
West Central	— 0.5	— 1.3	....
Southern States	— 6.3	— 4.6	....
Rocky Mountain	+ 2.6	— 2.2	....
Pacific	— 4.1	— 3.8	....
United States	— 6.6	— 6.6	— 4.7

Weekly Output, Millions of Kw.-Hr.

1938	1937	1936
Jan. 22..2,109	Jan. 23..2,257	Jan. 18..1,950
Jan. 15..2,115	Jan. 16..2,264	Jan. 11..1,971
Jan. 8..2,140	Jan. 9..2,244	Jan. 4..1,855
Jan. 1..1,998	Jan. 2..2,069	
1937	1936	1935
	Dec. 26..2,081	Dec. 28..1,847
Dec. 25..2,085	Dec. 19..2,275	Dec. 21..2,002
Dec. 18..2,202	Dec. 12..2,278	Dec. 14..1,983

Consumption in 1937 Up

Official returns rendered to the British Electricity Commission show that 2,500,000,000 units of electricity were generated by authorized undertakers in Great Britain during December, compared with the revised figure of 2,180,000,000 units in December, 1936, representing an increase of 320,000,000 units, or 14.7 per cent.

During the year 1937 the total amount of electricity generated by authorized undertakings was 22,905,000,000 units compared with the revised figure of 20,221,000,000 units for the year 1936, representing an increase of 13.3 per cent.

•

Electric Sales in Illinois

Total sales of electricity to ultimate consumers in Illinois as reported by eleven large electric utilities for December amounted to 610,282,396 kw.-compared with 614,282,023 kw.-hr. in December, 1936, a decrease of 0.7 per cent. This is the first time since this report has been issued that a decrease has occurred when compared with the corresponding month of the previous year. The December, 1937, sales are 2.5 per cent higher than those of the previous month.

•

Extra Dividends Declared

Board of directors of the Southern California Edison Company has authorized the payment on February 15 to stockholders of record on January 20 of the regular quarterly dividend of 37½ cents per share and an extra dividend of 25 cents per share on common stock. The board has also authorized the payment on April 15 to stockholders of record on March 20 of a special dividend of 25 cents per share on original preferred stock.

Bangor Hydro-Electric Company increased its dividend on the common stock with the declaration of 30 cents a share. Four payments of 25 cents each were made in 1937.

•

Ask Utility Tax Retention

The New York State Mayor's Conference has asked the 1938 Legislature either to permit cities to tax utilities for another year to finance unemployment relief or impose a state-collected, locally shared levy. Localities' permission to levy a 1 per cent tax on gross profits of utilities expires next June 30, along with the 1937 law under which the state imposes a 2 per cent tax, unless the Legislature grants extension.

Imposition of a state-collected, locally shared tax in preference to the utility levy was recently suggested by a legislative committee which studied the state's fiscal policies for six months.

•

127,384 Visit Schenectady

Announcement has been made that 127,384 persons visited the Schenectady works of the General Electric Company during 1937. In the course of a year there are visitors from every state in the Union, as well as from several foreign countries.

•

Gifts for Ohio Customers

Two more Ohio communities presented consumers with December paid bills for power, with the board of trustees at Willard, voting the gift, to total approximately $6,000, and the board of public affairs at Huron, Ohio, doing likewise, to the amount of $3,000. Oak Harbor and Wellington also gave receipted bills as gifts recently.

•

Power Contracts Signed

Ontario's new Gatineau, Beauharnois and Maclaren-Quebec power contracts, which are to effect a total saving of $92,657,000 during their lifetime, as compared with the original deals, have been signed by all parties concerned at the offices of the Ontario Hydro-Electric Power Commission. At the same time Hydro announced that it had applied for authority to export 120,000 hp.

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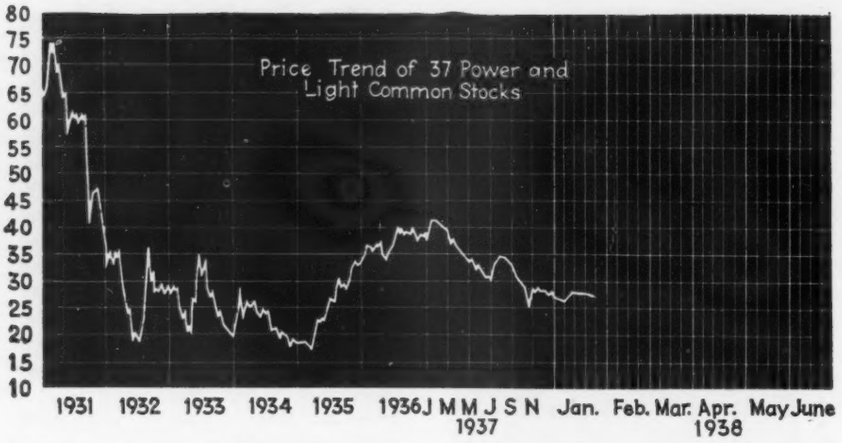
1937 Domestic Copper Sales

Domestic copper sales during 1937 amounted to 517,736 tons, as against 964,854 tons during 1936.

Utility Stocks Move Lower



Utility stocks continued lower this week, in the absence of encouraging developments to lift them and with interest lagging in the general market. "Electrical World" index, 26.7; previous week, 27.4; year ago, 40.5; 1938 high, 27.9, set week of January 15

New Capital Raised by Consumers Power

Public offering of $9,000,000 of first mortgage 3½ per cent bonds of Consumers Power Company last week found the new capital market in a highly receptive mood. The bonds, due November 1, 1967, were offered at 102, and immediately went to a premium.

The offering constituted new capital and the proceeds from the sale, estimated at $8,908,355, will be used by the company to pay for or to reimburse its treasury in part for net property additions.

In the last two years $105,596,000 of bonds were issued by the company to refund outstanding issues into ones bearing a lower rate of interest and for new capital. In addition, approximately $55,000,000 of new preferred stock was offered to refund outstanding preferred into an issue of lower yield. Through these operations the company was able to reduce fixed charges materially.

•

American Water Works Wins Plea for $6,000,000 Loan

SEC has issued an order making effective a declaration by American Water Works & Electric Company covering the issue and sale in connection with a bank credit of $6,000,000 of its 3½ per cent promissory notes of which $3,000,000 are to be dated on or before January 26, and $3,000,000 on or before July 15.

The company, which recently obtained approval of the SEC for a voluntary plan to simplify its corporate structure, desired to maintain the credit pending permanent financing of additions and improvements to the properties of its subsidiaries. The commission reserved jurisdiction to revoke, not later than June 15, its order in respect to the $3,000,000 of notes to be dated July 15.

•

Files Plans to Simplify Set-Up and Adjust Arrears

Community Power & Light Company has filed an application with SEC for a report on a plan of recapitalization to simplify its capital structure, adjust arrearages in preferred stock dividends and reduce dividend requirements on such stock. As a result of the reclassification the plan proposes to reduce the capital of the company by $5,837,720. The commission has called a hearing for February 23.

The company, the SEC said, will have accumulated dividend arrearages on February 1 on its first preferred stock of $2,586,075 and the plan provides for the elimination of this, to place the company in a position to finance its bank debt and the construction requirements of its subsidiaries through the sale of additional common stock.

•

Emerson Electric Offering

Public offering by means of a prospectus of 212,754 shares of common stock of the Emerson Electric Manufacturing Company, St. Louis, was made last week by a banking group headed by Van Alstyne, Noel & Company. The shares were offered at the current market price, which was approximately $6 per share.

Of the present offering, 39,986 and 77,754 shares were purchased by the underwriters from the company on September 20 and December 7, respectively, the proceeds being used for additional working capital, and the remaining 95,014 shares are under option from an estate.

•

Bond Issues Filed by Jersey Utility

Public Service Electric & Gas Company, Newark, N. J., has filed a registration statement with SEC covering $9,201,100 of 8 per cent first and refunding bonds due in 2037 to be used in exchange on a par for par basis for the outstanding capital stock of the South Jersey Gas, Electric & Traction Company, the Essex and Hudson Gas Company and the Hudson County Gas Company.

The company also registered $8,454,100 of 5 per cent first and refunding mortgage bonds due in 2037 to be used in exchange for the outstanding capital stock of the Paterson and Passaic Gas & Electric Company of Bergen County, New Brunswick Light, Heat & Power Company and the Newark Consolidated Gas Company. Both issues are under a plan to merge the above companies into the registrant.

•

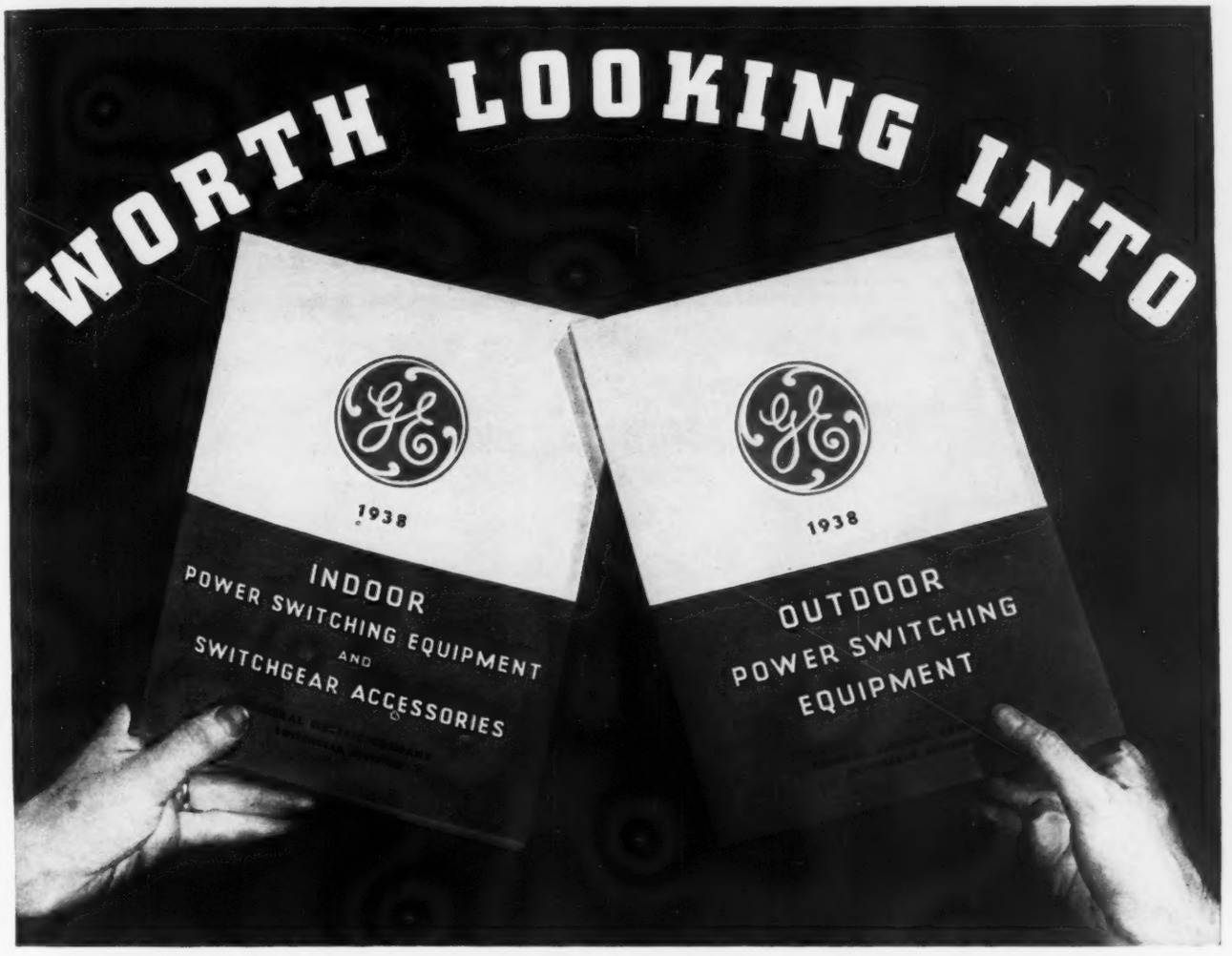
Notes Extended One Year

Notes of the American & Foreign Power Company, Inc., amounting to $22,800,000 owed to ten banks, which are due October 26, 1938, have been extended for one year beyond that date, according to a registration statement filed with the SEC and made public at the New York Stock Exchange. The rate of interest has been advanced from 4 to 4½ per cent.

Earnings Reports (Utilities)

	Net Income 1937	1936
*Pub. Serv. Corp. of N.J. and subs.	$24,531,606	$24,612,933
*American Superpower Corp.	921,718	863,243
*Detroit Edison	9,950,937	10,670,592
*United Corp.	10,692,598	10,269,858
†Duquesne Light	10,233,776	10,013,597
†Philadelphia Co. and subs.	7,822,455	8,342,411
†Elec. Pwr. & Lt. and subs.	9,505,143	7,915,766
†United Gas Corp. and subs.	10,875,512	11,668,257
‡Appalachian Elec. Pwr.	3,893,826	4,048,244
†Louisville Gas & Elec. (Ky.) and subs.	2,726,072	3,178,393
†North. States Pwr. (Minn.) and subs.	7,066,351	4,936,557

* Twelve months ended December 31.
† Twelve months ended November 30.
‡ Eleven months ended November 30, 1937, against twelve months ended December 31, 1936.



Because You'll Find the Answers to Questions Such as These:

Should a horn-gap switch have an interrupting rating?	(Page 71—Outdoor Book)
What's the cantilever strength of a standard 23,000-volt outdoor insulator?	(Page 19—Outdoor Book)
How can I co-ordinate outdoor fuses with relays and oil circuit breakers?	(Page 50—Outdoor Book)
What's the minimum phase spacing for a three-pole, group-operated, 69,000-volt switch?	(Page 77—Outdoor Book)
I want a 600-ampere, 23,000-volt, indoor, double-throw switch, one stud front-connected and the other stud back-connected. Can I get it without having it made up special?	(Page 51—Indoor Book)
What size and number of bus bars are best for carrying 4000 amperes a-c?	(Page 150—Indoor Book)
Can I get a control switch with a removable handle?	(Page 126—Indoor Book)

KEEP these two G-E catalogs at hand for quick reference. They'll actually save you hours a week by answering engineering questions as well as by giving promptly the ordering data you'll need on many small but important devices. If you haven't these two 160-page catalogs, ask your G-E office for GEA-626, Indoor; GEA-627, Outdoor; or write General Electric Company, Schenectady, New York.

GENERAL ELECTRIC

890-55

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Two Banks vs. One for Floodlighting

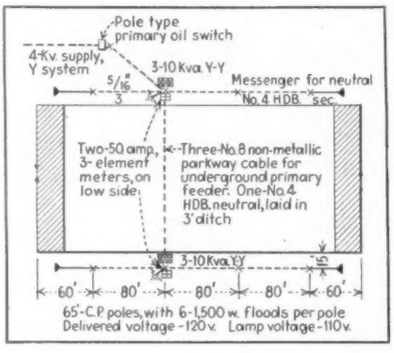
By O. V. BLANKENSHIP
Lighting Engineer
Alabama Power Company, Gadsden, Ala.

Two Y-connected transformer banks of three 10-kva. units each, located on opposite sides of the field, serve the 72-kw. floodlighting installation at the Etowah County High School athletic field. Non-metallic, underground, primary cables in a shallow ditch across the playing field from one bank to the other supply the second bank and avoid the necessity of using one transformer bank and running secondaries all around the field to serve the eight structures. First cost of this arrangement was lower than the other alternative, the length of the secondaries was less and the cost of the underground cable used was more than offset by the saving realized by the use of the smaller secondaries permitted. Through-bolts and spools instead of racks were used for mounting the secondaries.

By using this mounting method, the desired spacing between secondaries was obtained. Rather wide spacing was necessary since hard-drawn bare copper wire was used instead of weatherproof further to reduce cost.

Four 65-ft. CP. poles carrying six 1,500-watt floodlights each were spaced 80 ft. apart on each side of the field, as shown in the accompanying sketch. Since a Y system was used the load was perfectly balanced on each pole. A $\frac{3}{8}$-in. messenger was used for the secondary neutral.

Primary metering was first planned for this installation, but when the cost of three potential and three current transformers of the outdoor type was estimated it was evident that some other plan would have to be worked out. By installing two large-size three-element meters on the secondary side of each transformer bank the cost of the meter installation was reduced two-thirds.



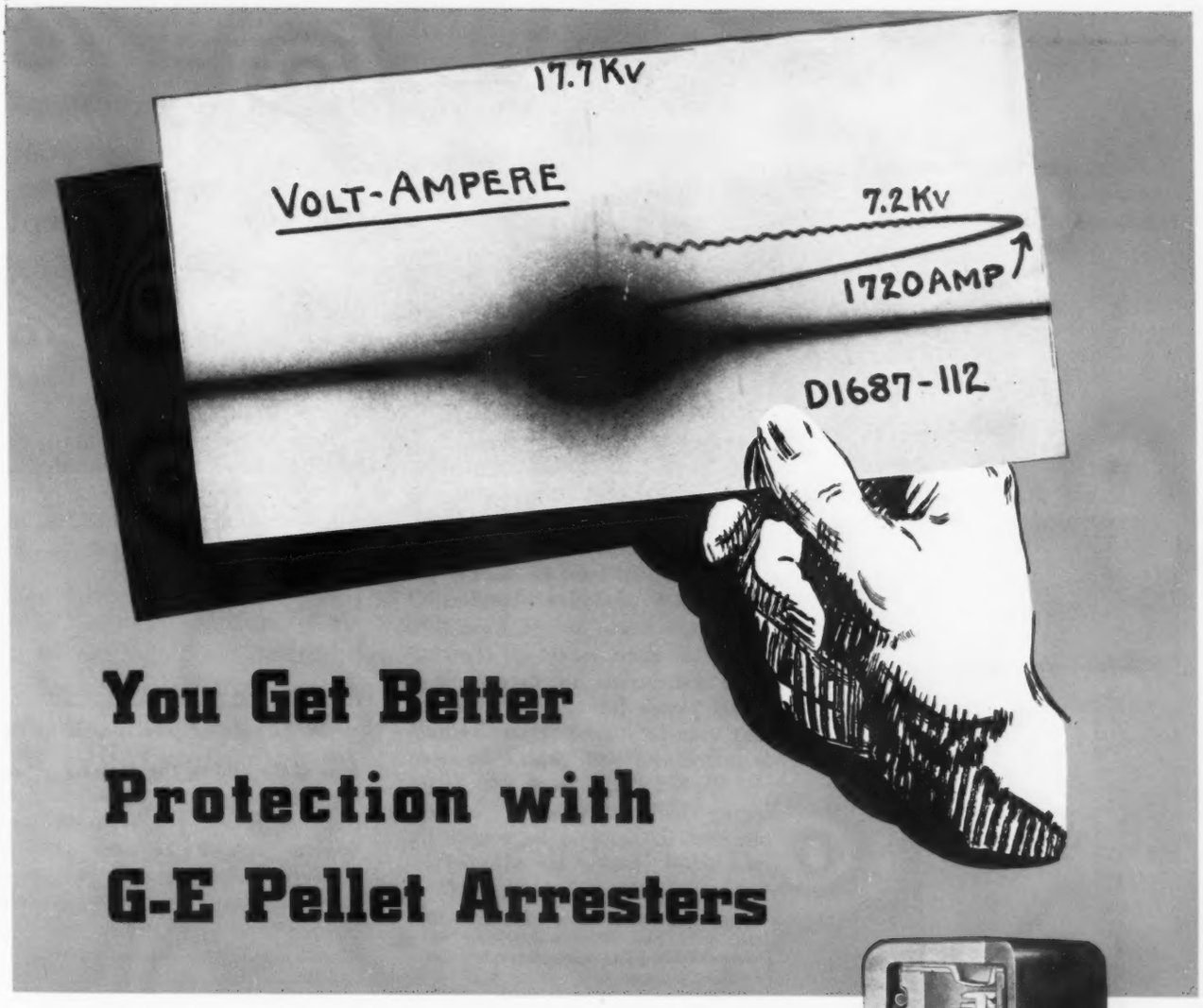
Two transformer banks cheaper than one for ball field lighting

Short run of parkway cable between primaries of two transformer banks avoids running secondary all around ball field to serve lights on both sides of the field.

Transformer Gasket Replaced Quickly

One of the large outdoor three-phase transformers at the Page Avenue substation of the Union Electric Company of Missouri, St. Louis, developed a leaky condition just below the lid. The gasket was bad and would have to be replaced. No spare transformer was available for this particular position and apparently the only thing to do was to take the line out of service while the transformer was in the repair shop. But was that necessary? Might not the transformer be left in position, the lid raised a few inches and the gasket replaced?

A certain amount of timber reinforcement was erected in the steel structure above the transformer to strengthen it so it would hold the weight of the lid. The oil level was lowered to be safely below the gasket line. At each of the four corners of



You Get Better Protection with G-E Pellet Arresters

LIGHTNING stresses on your distribution transformers are held to exceptionally low values when you install G-E pellet arresters, because these arresters, while discharging lightning current, limit the voltage to values lower than with any other type of protection. Note the accompanying cathode-ray oscillogram, which shows that a 1- to 3-kv pellet arrester, while passing a lightning current of 1720 amperes, limits the lightning voltage to only 7.2 kv crest.

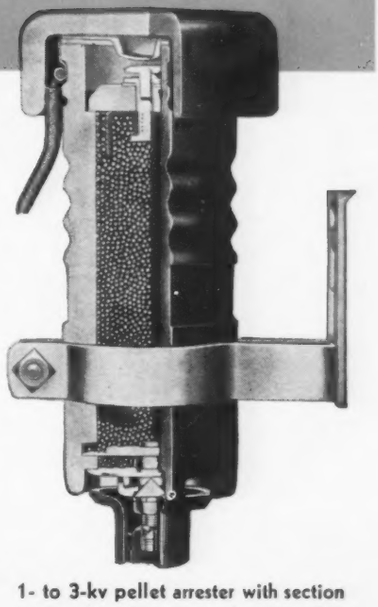
This low voltage means more positive preservation of transformer insulation and service continuity throughout severe lightning conditions.

G-E pellet arresters have been proved in service to have ample discharge current capabilities as determined by the actual field measurements of discharge-currents in distribution arresters.*

Pellet arresters are backed by General Electric's outstanding lightning research and test facilities. They have a background of established service reliability involving approximately 14,000,000 arrester-years.

These facts all point to G-E pellet arresters as offering the greatest return on your dollar investment in distribution protection. For a complete description of these arresters, ask for Bulletin GEA-93L. General Electric Company, Schenectady, N. Y.

*See 1935 A.I.E.E. transactions, page 1395; reprinted as G-E Bulletin GEA-2325.



1- to 3-kv pellet arrester with section removed to show internal construction

GENERAL ELECTRIC

330-261

OFFICIAL THERMOMETER KIOSK SHELTERS

This is not a birdhouse, but an effective shelter for the official thermometer at the Tewksbury divisional load-dispatching station of the New England Power System. Outside dimensions about 10x10x11 in., mounting about 5 ft. above ground and shelter-protected by louvers and waterproof roofing from rain, snow and ice.

without removing it from the testing rack. This saves some time, but the more important time saving lies in the fact that the adjustment is made more quickly with the jig and it is not necessary to touch the holding screw until the stop is in the exactly right position.

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Scale Map in Volts to Show Regulation

By BERTRAM E. ELLSWORTH
Electrical Engineer Iowa-Nebraska Light & Power Company, Lincoln, Neb.

Occasions often arise when it is very desirable to know the voltage conditions at a given point in a transmission line network. Such information aids in the selection of locations for the installation of regulators, in determining places where poor regulation may be expected or where large motors will cause trouble on the system due to their large constant load or high starting currents.

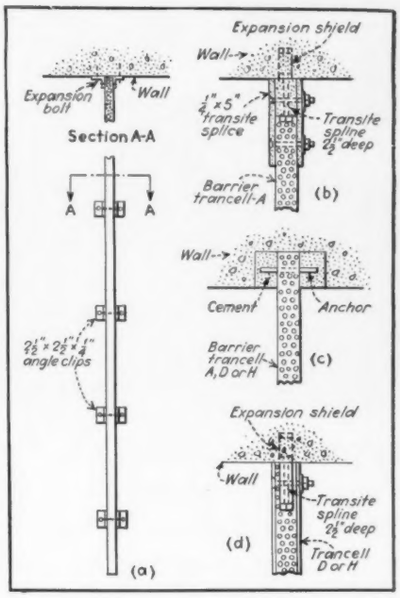
An impedance map of lines and equipment equalized for a given system voltage, has been used by some companies. Such a map takes into account length of lines, size and kind of conductors, wire spacing, voltage of lines and size of transformers. Such a map is useful for relay and short-circuit calculations, but does not reveal the true operating condition of a system due to the fact that heavier loads are required of some lines than of others.

A voltage map can be constructed from an impedance map by multiplying the line of transformer impedances by the line currents representing average peak load conditions. On such a voltage map the distances between system points represent the voltage drop in the transmission lines connecting them, as, for instance, one inch on the map might indicate a drop of 1,000 volts. If a town appears a long way from the generating station voltage conditions are likely to be poor, large motors will cause light flicker, etc., and, conversely, if the town appears close to the generating points voltage conditions will be good.

The ideal system would be one with equal distances between all cities and with these distances as short as possible. A city isolated such as K, which scales 4,700 volts (24 per cent) drop to the nearest generating station, will require regulators, generating equipment of its own or larger lines and transformers in order to maintain voltage during peak-load periods.

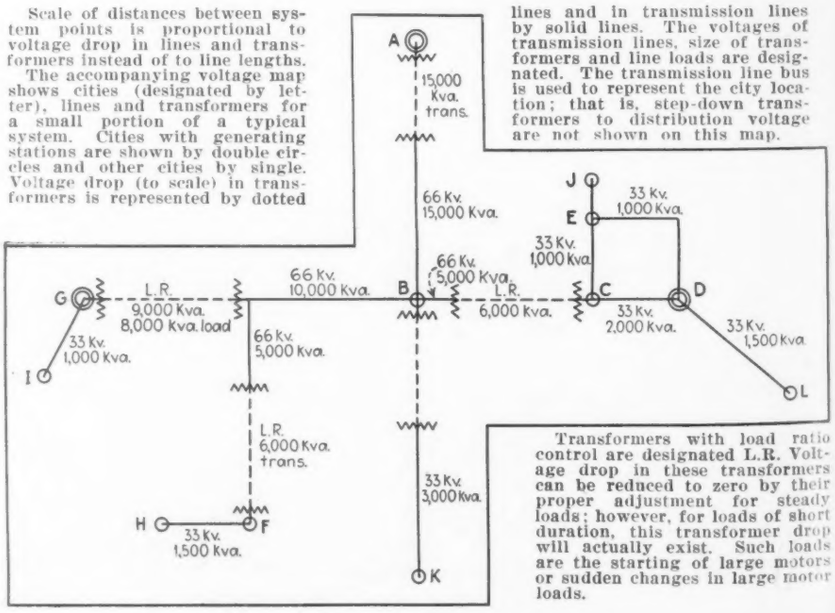
A fixed load power factor has been assumed. If this power factor is higher than approximately 60 per cent, then the actual voltage drop will be slightly less than the reading given by the map, due to the fact that the impedance drop is out of phase with the voltage. The correction to be made for a load of a given power factor will be very nearly a constant and can be approximately compensated for by the length of lines used in drawing the map.

HINTS ON CONSTRUCTING CELL STRUCTURES



Three methods recommended by Johns-Manville, Inc., for connecting the Trancell barriers of cell structures to the concrete walls of substations or power plants: (a) Angle clips fastened to walls with expansion bolts support the barrier sheet, (b) a Transite spline bolted to the concrete wall is spliced to the barrier by ¼x5-in. Transite battens, (c) barrier anchored in a slot provided in the wall, (d) similar to (b) with Transite or Flexboard encased material used as the barrier.

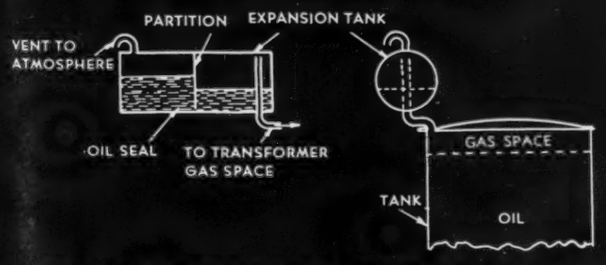
Scale of distances between system points is proportional to voltage drop in lines and transformers instead of to line lengths. The accompanying voltage map shows cities (designated by letter), lines and transformers for a small portion of a typical system. Cities with generating stations are shown by double circles and other cities by single. Voltage drop (to scale) in transformers is represented by dotted lines and in transmission lines by solid lines. The voltages of transmission lines, size of transformers and line loads are designated. The transmission line bus is used to represent the city location; that is, step-down transformers to distribution voltage are not shown on this map.



Transformers with load ratio control are designated L.R. Voltage drop in these transformers can be reduced to zero by their proper adjustment for steady loads; however, for loads of short duration, this transformer drop will actually exist. Such loads are the starting of large motors or sudden changes in large motor loads.

System voltage conditions at a glance

O EXTRA CHARGE FOR THIS FEATURE • IT'S STANDARD ON ALLIS-CHALMERS POWER TRANSFORMERS



THIS IS THE OIL-SEALED SYSTEM

• When the oil in the main tank expands due to increase in temperature, a slight pressure is exerted on the gas above the oil. This pressure increase is transmitted to one section of the expansion tank causing the oil level to drop in it and rise in the other. The movement of oil in the expansion tank adds volume to the entrapped gas to compensate for the expansion of oil in the main tank, so the gas space above the oil is isolated from the atmosphere under all operating conditions. The oil in cooling contracts and reduces the pressure on the gas, causing the reverse action to take place.

YOU DON'T HAVE TO CONSTANTLY REPLACE NITROGEN WITH THE OIL-SEALED SYSTEM

• You can cut power transformer operating costs and reduce maintenance to a minimum with the Allis-Chalmers Oil-Sealed Inert Gas Protective System — furnished only on Allis-Chalmers Power Transformers • First — you don't have to take time out to replenish costly nitrogen gas and that saves you time and money • Second — you don't have to periodically adjust or replace pressure reducing valves, which is important, for it means you have no maintenance worries, no maintenance expense • The Allis-Chalmers Oil-Sealed System, different from any other system in the world, operates simply and automatically, with no moving mechanical parts, nothing to get out of order, nothing to wear out • Tests all over the country have proved that the Oil-Sealed System keeps the oil free of sludge, oxygen, and moisture even after the transformer has been in service for many years • The Oil-Sealed System is just one of the Allis-Chalmers features, bringing safer and money-saving transformer operation to transmission systems all over the country • Other exclusive Allis-Chalmers features are: Unusual Core and Coil Assemblies, the Unidirectional Breather, No-Load Tap Changer, Oil-Tite Construction, Combined Expansion Tank and Relief Device, and Tap Changing Under Load with unusual conveniences • Make your dollar go farther — cut operating costs — specify Allis-Chalmers Power Transformers.

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TRANSFORMER DIVISION
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New ENGINEERING IDEAS

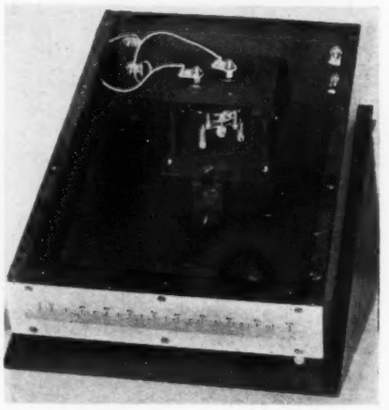
Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Light-Beam Pointers Cut Reading Time

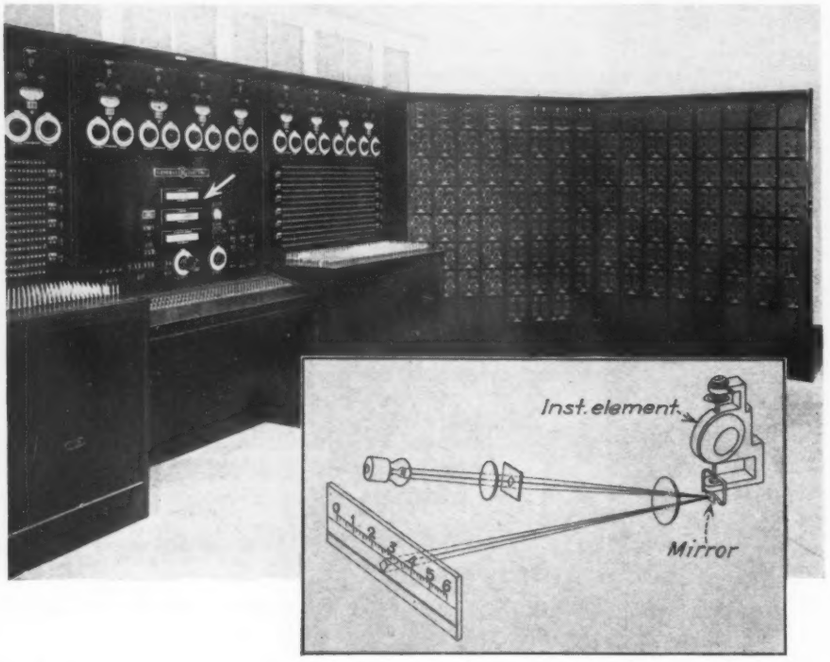
By EVERETT S. LEE
Engineer, General Engineering Laboratory, General Electric Company, Schenectady

Use of a light beam as a pointer for reflecting galvanometers is familiar, but its application to indicating instruments as a pointer is not so common. Such an arrangement is illustrated herewith. Eliminating the pointer allows the use of a well-damped lightweight armature to be employed with dead beat performance for fast operation. such as full scale deflection over an 8-in. scale in about one-third of a second.

Such instruments have resulted in several new applications. A new electrostatic voltmeter with a light-beam pointer revives interest in the old attraction type electrostatic voltmeter whose pointed mechanism often required three or four minutes to come to rest. Now the light-beam pointer with magnetic damping gives. and without parallax, an indication within three or four seconds. An outstanding application of the light-beam principle is on a new a.c. network analyzer. A voltmeter, ammeter and wattmeter-varmeter using this principle are on the central panel of the analyzer. The light-beam pointers appear distinctly on the 8-in. glass scales and move quickly from position to position as the instruments are introduced quickly into the network analyzer circuits for measurement. By use of these instruments the time required for taking readings is reduced to about one-third of that required with pointer instruments of conventional design.



Cover removed from light-beam instrument used on network analyzer shows arrangement of component parts



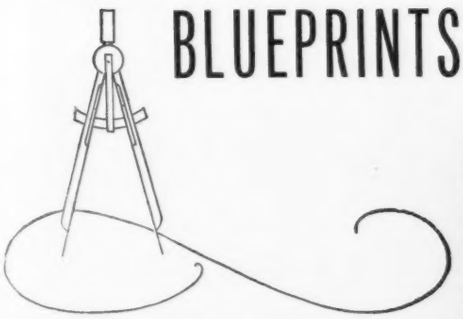
Light-beam pointers on instruments for a.c. network analyzer reduce time required for readings about one-third

Inset shows arrangement of light source, lens, aperture, mirror on shaft of instrument element and lens to give projection on translucent glass scale.

An additional feature of this measuring equipment is the use of stabilized precision amplifiers so that the power taken from the analyzer system for voltage and current measurements is very small compared with the amplified values to operate the instruments.

Other applications have been in resistance measuring devices for production purposes, in wattmeters for

BLUEPRINTS FROM A SPECIAL HANDBOOK



KRIBBING POINT
OR
TIE BETWEEN TWO FEEDERS
featuring
KEARNEY CON-NEC-TITES

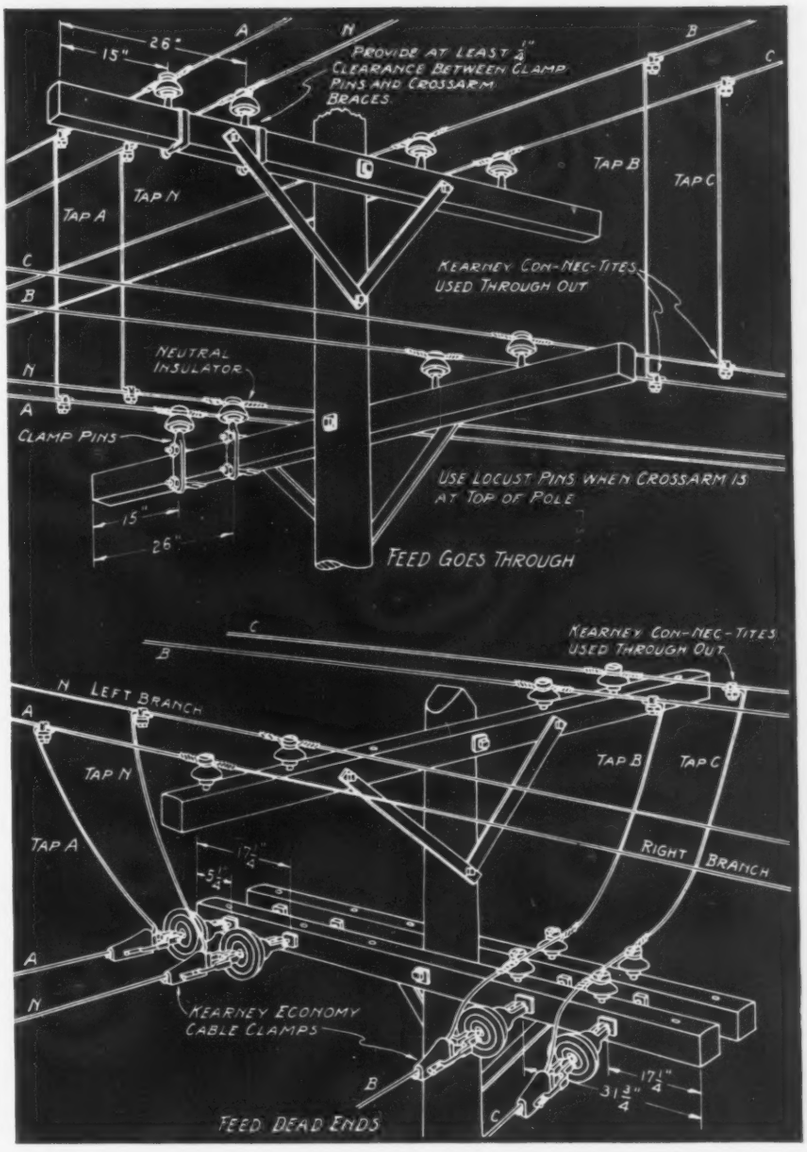
You can permanently connect two feeders on a junction pole, as here shown, by means of vertical risers and Kearney Solderless Wire Con-Nec-Tites.

Where switching is provided for on poles adjacent to the corner pole, the feeders are permanently connected at the corner pole or dead-end pole, as the case may be.

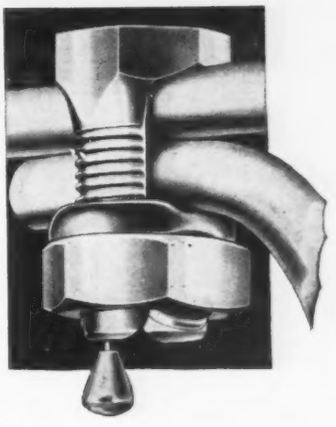
Below, on the print, you'll notice that Kearney Economy Cable Clamps do a neat job in dead ending and are connected directly to the branch feeder extending in both directions.

As an operator, you'll want to see how Kearney Con-Nec-Tites and Economy Cable Clamps, with their special features, afford worthwhile construction advantages. Direct your questions or inquiry to us and we'll gladly cooperate with you in furnishing information.

FREE — "Blueprints" of six previous constructions, bound in a pad, are yours for the asking.



Kearney Con-Nec-Tites are easily threaded — quickly installed — no binding — no cross-threading . . . Constantly improved over a period of ten years by field-trained engineers. You'll like the mechanical and electrical refinements built into Kearney Con-Nec-Tites Specify them and assure yourself dependability in all connections.



The Mark of JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *Quality Products*

DESIGNED AND MANUFACTURED BY

JAMES R. KEARNEY CORPORATION: 4200-42 CLAYTON AVE., ST. LOUIS, MO.

production testing, and more recently in an indicating wattmeter used ballistically.

•

Graphical Aid to Economic Selection

By RUSSELL C. PUTNAM
Associate Professor of Electrical Engineering, Case School of Applied Science, Cleveland, Ohio

The engineer with a long-range view must always consider the problem of present versus future expenditure; whether to spend money now or later. In general, the decision can be made by comparing either present worth or future values of the various alternatives.

Equations for such calculations as well as compound interest and present worth tables are available in books on financial mathematics. However, a rapid and simple method of computation of slide rule accuracy is sufficiently exact for preliminary determinations, particularly where the interest value used is obtained from estimated future earnings of the business or other approximations. Such a solution is possible with the accompanying nomograms.

Chart I is based on the equation:

$$P.W. = \frac{1}{(1+i)^n} A$$

where $P.W.$ is the present worth of the amount A at interest rate i compounded for n periods. By changing the designation of two of the scales the same chart may be used for the compound interest equation:

$$F.W. = P(1+i)^n$$

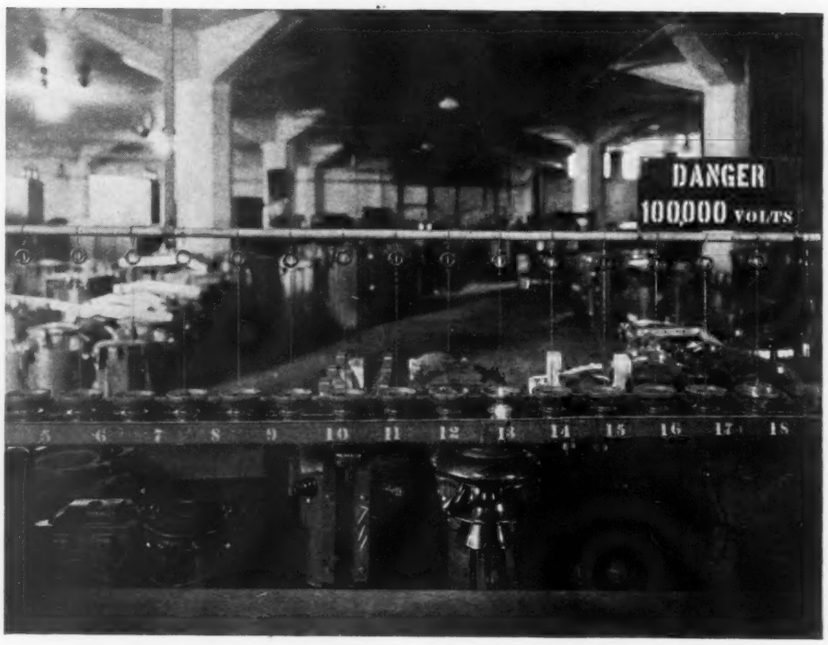
where P is the principal and $F.W.$ the final accumulated figure. For example:

A choice is to be made between spending $10,000 now for ten years useful life or $6,000 now and $6,000 in five years to accomplish the same result. Money invested in this business has in the past shown an average return of 10 per cent and this figure is therefore chosen as the interest rate.

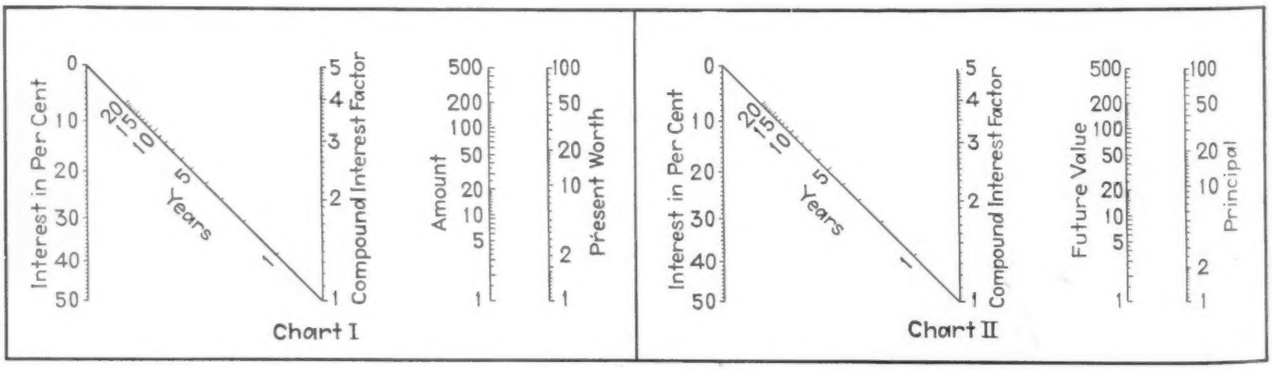
Present worth of $10,000 is $10,000. Present worth of the other plan is $6,000 plus the present worth of $6,000 spent five years from now. This latter amount may be found from chart I by drawing a straight line through the 10 per cent on the interest scale through the five-year point on the diagonal scale to the compound amount factor scale. From this point a second line drawn through 6 ($6,000) on the amount scale will intersect the present worth scale at 3.75 ($3,750). Thus the present worth of the second plan is $6,000 plus $3,750 or $9,750, against $10,000 for the first plan.

Chart II is designed to give the future value of an amount compounded over a period of time. For example: To find the future value of $15,000 at 8 per cent for a fifteen-year project draw a straight line from 8 per cent on the interest scale through 15 on the year scale and from its intersection on the compound amount factor scale draw a second line to 15 on the principle scale. It intersects the future value scale at 47.5. The future value is therefore $47,500.

INDICATORS SHOW DEFECTIVE INSULATORS



For testing line insulators, C. A. Warren, transformer foreman Portland General Electric Company, Portland, Ore., developed this apparatus. Suspended from a 1-in. pipe by chains which form part of the circuit, insulators hang within the trough containing ½ to 1 in. of water. Wooden rings, 1⅛ in. inside diameter, with screw-eyes set through opposite sides, serve as indicators. Here, glass insulators from an 11,000-volt line are being subjected to 30,000 volts. No. 13, which is cracked and defective, shows a heavy arc across the indicator and a flash in the insulator itself. If the voltage were increased, other indicators would stop operating and No. 13 would show a white power arc. Besides enabling men making tests to identify defective insulators quickly, these indicators protect the test transformer from heavy current surges during insulator failure.



Nomograms solve engineering economics problems

Chart I performs present worth computation and Chart II determines future value of amount compounded over a period

PHOTO BY N. E. S.

IN Mexico, at the markets, Indians gather by the hundreds to offer their wares for sale. They deal in peppers, oranges, fowl, silverware, pottery, leather goods and many other products. Their sales methods are born of a long experience which has taught them that a lavish display leads to the best results. A pause at their stands invariably results in the sudden materialization of a silver bracelet or possibly a slender, horn handled machete dangling before your nose. You may find a pair of woven leather sandals in your hands, placed there by some mysterious means. Articles of interest are handed to you from all sides to be *examined* as closely as you choose.

A valuable asset, this method of selling, one which you as the Public Utility man and the producer of an invisible commodity, cannot utilize. It is impossible for the housewife or factory owner to handle your product, weigh it, and judge its quality. You must sell your product, Electric Current, on the basis of uninterrupted operation and service—an abstract qualification which can be SOLD WITH ASSURANCE when you know you are backed by HUBBARD HARDWARE.

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Industrial ELECTRIFICATION

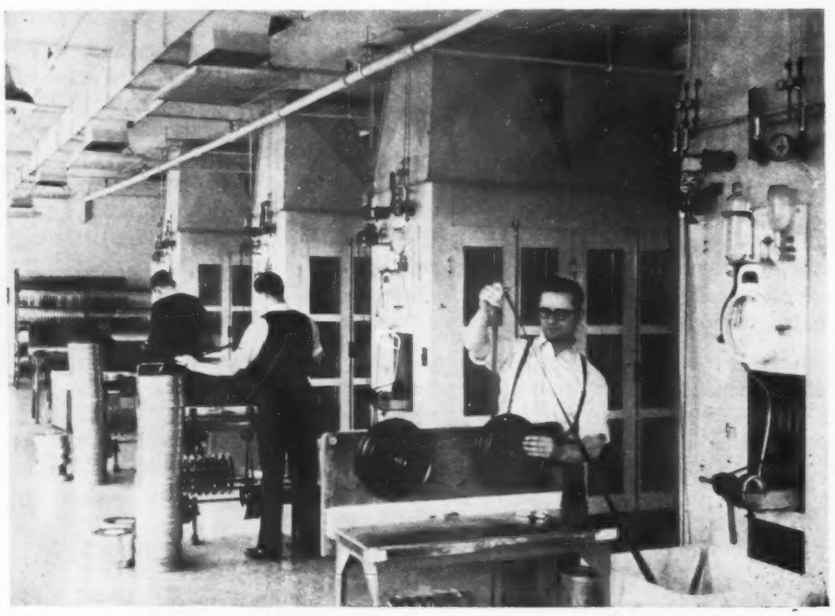
New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Control Atmosphere in Film Manufacture

By **FRANK LE GRANDE**
Paramount Pictures, Inc.,
Astoria, Long Island

Air conditioning is practically indispensable in the printing, developing and drying processes involved in the mass production of high quality motion-picture films if consistent results are to be obtained. This is necessary since the sensitized gelatine coating on the film is not only temperature sensitive but also hygroscopic (moisture absorbing). An air-conditioning installation rated at 96 tons and capable of handling 70,000 to 90,000 cu.ft. of unconditioned air is used at the Long Island Laboratories of the Paramount Pictures, Inc., Astoria, to control temperature and humidity conditions in the production of movie film.

Moisture-laden air, drawn, in this instance, from the process room for recirculation, is passed through "spray headers" where a cold spray (34-38 deg. F.) eliminates any free or entrained moisture. Water for the spray is cooled by a methyl-chloride refrigerating machine or water cooler located in the basement. From the dehumidifier or spray header, air is led by ducts to air preheaters, where its temperature is raised before introduction into the various rooms. Temperature and humidity controllers located in the process rooms and connected to dampers in the ducts regulate the temperature and amount of air used.



Conditioned air essential to proper drying of movie film

Air at about 50 per cent humidity passes through these drying chambers flowing counter to movement of film

In the printing room, where positive or projector film is printed from the negative, air is maintained at a relative humidity of about 52 per cent. This corresponds to a dry bulb temperature of 72 deg. F. and a wet bulb temperature of 60 deg. F. After printing, the film goes to the developing rooms, where it is passed continuously through developing, fixing and washing solutions. Humidity in the room is somewhat higher than in the printing room, since it is desirable to make the transition from the dry gelatine of the printing room to the saturated gelatine on films in the developing solution as gradual as possible. This avoids shock that might be detrimental to the film. A dry bulb temperature of 68 to 70 and a wet bulb temperature of 65 deg. is maintained here. This corresponds to a relative humidity of 75 to 80 per cent.

After being developed and washed, films pass over reels into drying chambers in the drying room. As far as humidity is concerned, this is perhaps the most critical part of the process. Flow of air in these glass-inclosed drying chambers is counter to the movement of the film to insure the maintenance of constant wet bulb temperature as near as possible. Dry bulb temperature is held at 78 deg. and wet bulb at 64 deg. F. or relative humidity of approximately 50 per cent. Passing from the drying chambers, the film receives a routine inspection before being wound on spools for shipment to the cutting rooms.

The entire air-conditioning plant totals 200 hp. and is a Carrier Engineering Company installation. Wet and dry bulb temperature recorders of the Taylor type are used.

A pair of hands are the only tools needed when tying in Copperweld-Copper Conductors. Ties are made with simple annealed tie wires—one piece of wire to an insulator.

Since these rugged 3-wire conductors have no tendency to vibrate—even when strung at high tensions on long spans—special devices to combat vibration and special tools for installing them are never required. A pair of hands are the only tools needed when tying in Copperweld-Copper Conductors.

Simplicity of construction resulting in LOW labor costs—rugged dependability resulting in LOW operating costs—these are two of the reasons for the trend to Copperweld-Copper Conductors for rural line construction. Specify Copperweld-Copper Conductors and—

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COPPER CONDUCTORS

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Savings Pay for Rebuilt Transformers

By reconditioning two banks of three thirteen-year-old 5,000-kva. oil-insulated transformers and changing them from water-cooled design to self-cooling the electrical engineer of a large eastern industrial plant found that the savings in the cost of cooling water alone will pay for the $10,000 investment required in four years. These outdoor transformers, rated at 66 kv./6.6 kv. and totaling 30,000-kva., were of the older design, with plain dehydrating breather and self-draining cooling coils. Tanks contained approximately 2,000 gal. of oil each.

The reconditioning program called for replacing the water-cooled tanks with radiators and air-blast blower equipment. Original cores, tap changers, bushings and oil were reused. New boiler plate tanks 77 in. in diameter, with "header designed" radiator assembly and motor-operated blowers, replaced the 69-in. tanks formerly used and increased the oil per transformer from 2,000 to 3,200 gal. The change in tank size will make it possible at some later date to replace the present cores with others of more liberal design and thus increase the full load rating 35 per cent.

With the self-cooling and air-blast blowers automatically controlled by the temperature relays these transformers can be operated up to 75 per cent load without the blowers operating. At that point the blowers start up and the transformers can be operated at full capacity without exceeding standard temperature guarantees. As the normal steady load is about 75 per cent of capacity, the blowers will operate only during the exceptionally warm summer months.

This group of transformers, reconditioned with the aid of E. A. Brown of the Westinghouse Electric & Manufacturing Company, is similar to many throughout the country, and this case illustrates what can be done at minimum expense by carefully analyzing the condition and reliability of apparatus.

•

Maintenance Pays Dividends in Light

Losses arising from neglect of lighting equipment have been proved to reduce the possible illumination by an estimated amount of easily one-third, while cleaning costs alone, amounting to only about 4 per cent of the total operating costs of a lighting installation, may increase illumination 20 to 25 per cent, according to Samuel G. Hibben, director of applied lighting, Westinghouse Lamp Division. Losses due to neglect may be roughly classified as follows:

1. Dirty lamps and accessories.
2. Darkened or discolored walls and ceilings.
3. Lamp bulbs of poor quality or low efficiency.
4. Empty sockets or unobserved burnouts.
5. Aged lamps past their prime of usefulness.
6. Under-voltage burning of lamps.
7. Improper combination of lamp and reflector.

1. Dirty Lamps and Accessories—Usually the greatest losses in efficiency due to deposits of dust on lighting equipment occur in the first month or six weeks. Experience has shown that bulbs and reflectors should be wiped free of dust at least once each month. They should be washed once every sixty days. In a typical office building, glassware can be removed, scrubbed, dried and replaced in four or five minutes at a cost of from 5 to 15 cents per visit.

2. Darkened or Discolored Walls or Ceilings—How much the reflection coefficient may be increased by washing is impossible to answer definitely, but figures indicate that an increase of 10 per cent is not uncommon.

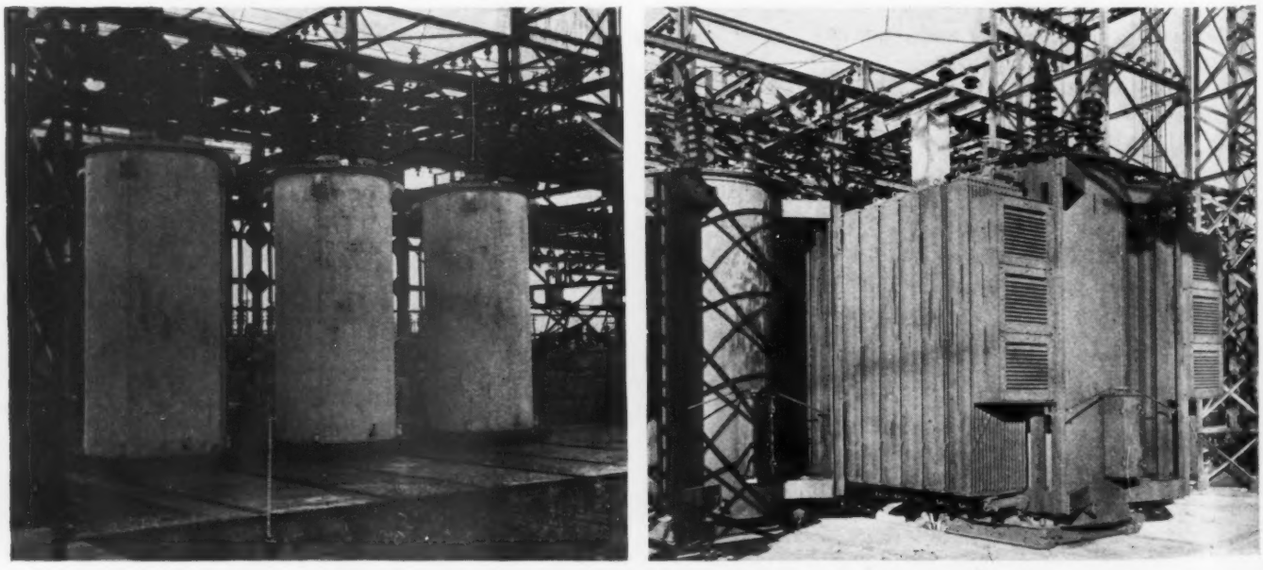
3. Lamp Bulbs of Low Quality—The cost of a lamp usually represents less than 10 per cent of the total cost of lighting. A few cents difference in its cost is negligible, but a few per cent gained in output efficiency is vitally important.

4 Empty Sockets—Fixed charges, as cost of installation and investment, continue whether the socket is empty or full.

5. Aged Lamps—Aged lamps should be removed, even though still capable of burning. Consider a 100-watt Mazda lamp which a reasonably large user will purchase for 20 cents. During its 750 hours rated life it uses 75 kw.-hr. at 3 cents per kilowatt-hour at a cost of about $2.25. A 9 per cent average loss of efficiency during such a burning time (say the second 750 hours) would be equivalent to 20 cents, or the cost of a new lamp.

6. Under-Voltage Burning—Voltage drop in any system should not exceed 2 per cent. A 1 per cent drop in voltage amounts to a 3 per cent diminution of illumination. Economy, therefore, dictates closest possible agreement between rated lamp voltage and the actual socket voltage.

7. Improper Matching of Lamp and Reflector—If the wrong size lamp is used in the reflector the emitted beam is changed and the combination loses effectiveness. A 200-watt size of RLM reflector and corresponding lamp will emit light with an efficiency of about 70 per cent. A 150-watt lamp in this same reflector will yield an output efficiency of 62 per cent.



Modernizing two thirteen-year-old water-cooled transformer banks and changing to self-cooled design pays for $10,000 investment in four years

Left—Before modernization. Right—After modernization

Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Night Accidents Cut by Proper Lighting

By R. E. GINNA
Manager Rate and Contract Department, Rochester Gas & Electric Corporation. Rochester, N. Y.

Once again the effect of proper highway lighting on night traffic is exemplified in reduced night accidents, this time along St. Paul Boulevard, a heavy traffic artery running from Rochester, N. Y., to Lake Ontario.

Prior to July, 1936, motorists traveling this main route at night had to depend entirely upon automobile headlights to furnish visibility. In that month the Rochester Gas & Electric Corporation installed more than a hundred 10,000-lumen sodium luminaires along more than 4 miles of the route. This safety movement was authorized by the Monroe County Board of Supervisors. The system has now been in operation for more than a year. Let us compare traffic accidents on the boulevard one year prior to and one year after the sodium safety lighting.

One Year Before Lighting

Night Accidents		Daylight Accidents
Sunset to Midnight	Midnight to Dawn	
7 accidents, 1 fatal	5 accidents	8

Total—12 Night, 8 Day

One Year After Lighting

Night Accidents		Daylight Accidents
Sunset to Midnight	Midnight to Dawn	
4 accidents	0	6

Total—4 Night, 6 Day

The above figures show a reduction in night accidents of 67 per cent, while day accidents decreased but 25 per cent. Assuming the factors which decreased day accidents 25 per cent also had the same effect on night accidents, this leaves 55 per cent as the decrease due to proper lighting.

The splendid reduction in night accidents is all the more remarkable when one considers that since the improvement of lighting conditions along the boulevard night traffic has lately increased tremendously.

Of interest, too, is the opinion of policemen whose duty it is to patrol the boulevard at night. They believe the sodium lighting has made their jobs easier. The patrolmen are especially pleased with the reduced glare from oncoming headlights, which seems negligible under the sodium color, orange-yellow.

The local press is quite enthusiastic about the improved lighting, as evidenced by the following editorial appearing recently in the *Irondequoit News*. Irondequoit is one of the fast-growing communities through which St. Paul Boulevard passes. I quote the editorial:

> Path of Gold lights, installed in St. Paul Boulevard a year ago, have performed miracles in accident prevention. Not one pedestrian was struck by an auto in that period. Such accidents were averted because drivers could see pedestrians and also the pavement.
>
> St. Paul Boulevard was a slaughterway before Path of Gold lights were installed. Three persons were killed there in two years, and the casualty among animals was appalling. Before those effective golden lights were used it was unsafe for adults and children to walk in or across that highway.
>
> The Path of Gold lights give St. Paul Boulevard such a restful-to-the-eyes illumination that driving therein is as safe at night as in broad daylight. Thousands of motorists come from far distances to see this marvelous display. No mistake was made in accepting the Rochester Gas & Electric Corporation's recommendation of these lights, and we urge other major highways to petition for the Path of Gold lights.

The effective illumination and subsequent results in accident prevention have been a stimulus to the street and highway lighting field in general, as evidenced by numerous requests of neighboring town and village authorities for a study of their lighting. Of the numerous studies made, results achieved to date show three villages and one

General Electric Company

Sodium safety lighting on St. Paul Boulevard at Rochester, N. Y., which has decreased night accidents

town with lighting stepped up 50, 300, 300 and 600 per cent respectively. Good lighting is recognized as a wise investment by taxpayers.

•

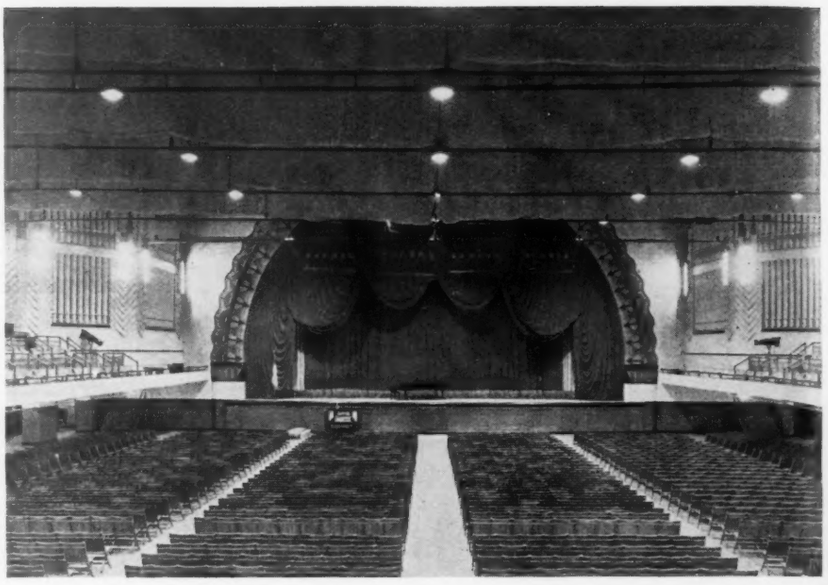
Better Lighting Proves Economical

By F. RAYMOND ARCHER

An example of improved and still of more economical lighting is the relighting of the auditorium of the Westchester County Center building in White Plains, N. Y. This building was erected in 1930 and in less than seven years of operation it was necessary to relight it because of public opinion.

The lighting in this auditorium was previously effected by a heterogeneous assortment of reflectors all grouped together in a concentrated area of a skylight pouring out a blast of light totaling 28,000 watts. There were a total of 56 500-watt lighting units producing an intensity of illumination on the working area of the auditorium of but 3 foot-candles. The light was all being thrown to the center of this very large room, creating harsh shadows and varying intensities, and was so inadequate that every time a show was scheduled the management had to provide temporary lighting or the individual had to furnish his own temporary lighting in order that the public could see his display.

Because of the public's continual disapproval of the lighting condition, the management finally was forced to call on the services of an illuminating engineer to remedy the situation. The lighting system was redesigned to provide adequate illumination and to operate economically.



Auditorium of Westchester County (N. Y.) Center Building is illuminated by 40 500-watt units producing 12 foot-candles

The new system consisted of 40 500-watt aluminum high bay fixtures spaced symmetrically on 20x25 foot centers and mounted 34 ft. from the floor. An even intensity of 12-foot-candles was secured. The new lighting installation gives four times as much light and uses 8,000 watts less demand than the old installation. To do a little figuring at random, let us assume that this public building can purchase electric service at $3\frac{1}{2}$ cents per kilowatt-hour and that the auditorium is lighted four hours per night, three nights per week for fifty weeks during the year. Using these figures as a fair average, the reduction of 8,000 watts means that four times the quantity is obtained, at a saving to the taxpayers of approximately $168.00 per year. Not only did the new lighting installation effect the economic operation of the system but it also increased the flexibility. All lighting units are now controlled by dimmers, which relieve the eyestrain caused by rapidly changing intensities. The three lighting units that are directly over the front part of the stage are separately controlled so as to spotlight speakers or adequately illuminate the orchestra. The fixtures lighting the main floor area of the auditorium are of sufficient size and the wiring is of ample capacity to make use of 750-watt lamps, which will produce an intensity of illumination of 18 foot-candles if at any time it should be desired.

SHOES FOR THE SHOEMAKER'S CHILDREN

New service building of Utah Light & Power Company has high-intensity illumination. In the main office, shown here, are 34 totally indirect 300-watt units providing 35 foot-candles on the working plane

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handle most PRIMARY distribution line requirements

3 SIZES

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TYPE 670—FOR VOLTAGES UP TO 10,000
TYPE 680—FOR VOLTAGES UP TO 15,000
Handle most PRIMARY line requirements

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Try these better insulators on your next job—learn why their use on your primaries will mean lower initial and over-all costs. Send today for samples. Owens-Illinois Glass Company, Hemingray Division, Muncie, Indiana.

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FOR MODERN POWER LINE INSULATION

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News ABOUT PEOPLE

Z. E. Merrill Made President of Mountain States Power

Z. E. Merrill, formerly vice-president in charge of operations of the Mountain States Power Company, Albany, Ore., was elected president of the company at a recent meeting of the board of directors. He succeeds C. M. Brewer, who was also president of the California Oregon Power Company and still retains that position. Mr. Brewer retains a position on the board of Mountain States.

Mr. Merrill has been with the Mountain States organization for fifteen years, holding the position of assistant general manager until 1931, when he was made vice-president in charge of operations. His experience in the util-

ity field began immediately after graduation from college, when he joined the Milwaukee Electric Railway & Light Company in construction work. A connection followed with the Washington Water Power Company, Spokane, and then he operated small telephone and electric utilities in Washington. From 1917 to 1918 he served as electrical engineer for the U. S. Reclamation Service in Denver.

Following the World War, he joined the Public Service Commission of Washington, as it was then called, leaving that body to become operator for the receiver for the Wenatchee Valley Gas & Electric Company, Wenatchee, Wash. He then joined Mountain States Power.

•

G.E. Names Cordiner Head of Appliance Department

Ralph J. Cordiner has been appointed manager of the appliance and merchandise department of the General Electric Company. He has served as assistant manager of the department since December, 1936. In his new position Mr. Cordiner will be responsible for the company's entire appliance and merchandise operation, which includes four major divisions—specialty appliances, household appliances, radio and construction materials. He will make his headquarters at Bridgeport.

Mr. Cordiner's experience in the merchandising of a wide variety of electrical products and his familiarity with the various sections of the country in which he has been located have specially fitted him for his new position.

•

▶ DARROW SAGE, superintendent of the Kearny generating station of the Public Service Electric & Gas Company of Newark, N. J., for ten years, was recently made mechanical maintenance engineer in the general office, electric generating department, Newark. Mr. Sage has been associated with Public Service since 1920.

▶ GEORGE A. BIHLER, superintendent of lines and service for the Utah Power & Light Company at Bingham, has been appointed manager of the company's Bingham division, succeeding the late J. B. Myers. Mr. Bihler has been in the employ of the company in this territory for the past fifteen years, having first become associated with the power business in 1913, when he entered the employ of the Phoenix Utility Company, aiding in construction of the Utah Power & Light's hydroelectric generating stations on the Bear River.

Dr. Henry E. Riggs Elected President of A.S.C.E.

Dr. Henry E. Riggs, honorary professor of civil engineering at the University of Michigan, was elected president of the American Society of Civil

Engineers for the year 1938 at the annual meeting held last week. Though by education and practice Dr. Riggs is essentially a civil engineer, he is well known in the electrical industry for his outstanding work in the valuation field.

He has made important studies on valuations of electric and gas properties, serving in a consulting capacity for the state commissions of Michigan, Georgia, New York and has been retained by many cities, corporations and by U. S. courts.

He is the author of "Depreciation of Public Utility Property" and of various papers and articles in the technical press. Dr. Riggs is a member of the Society for the Promotion of Engineering Education and of other technical associations.

•

▶P. M. Ross has been appointed superintendent of the high-voltage laboratory of the Ohio Brass Company. Mr. Ross has been associated with the engineering department of the Barberton (Ohio) division of the company

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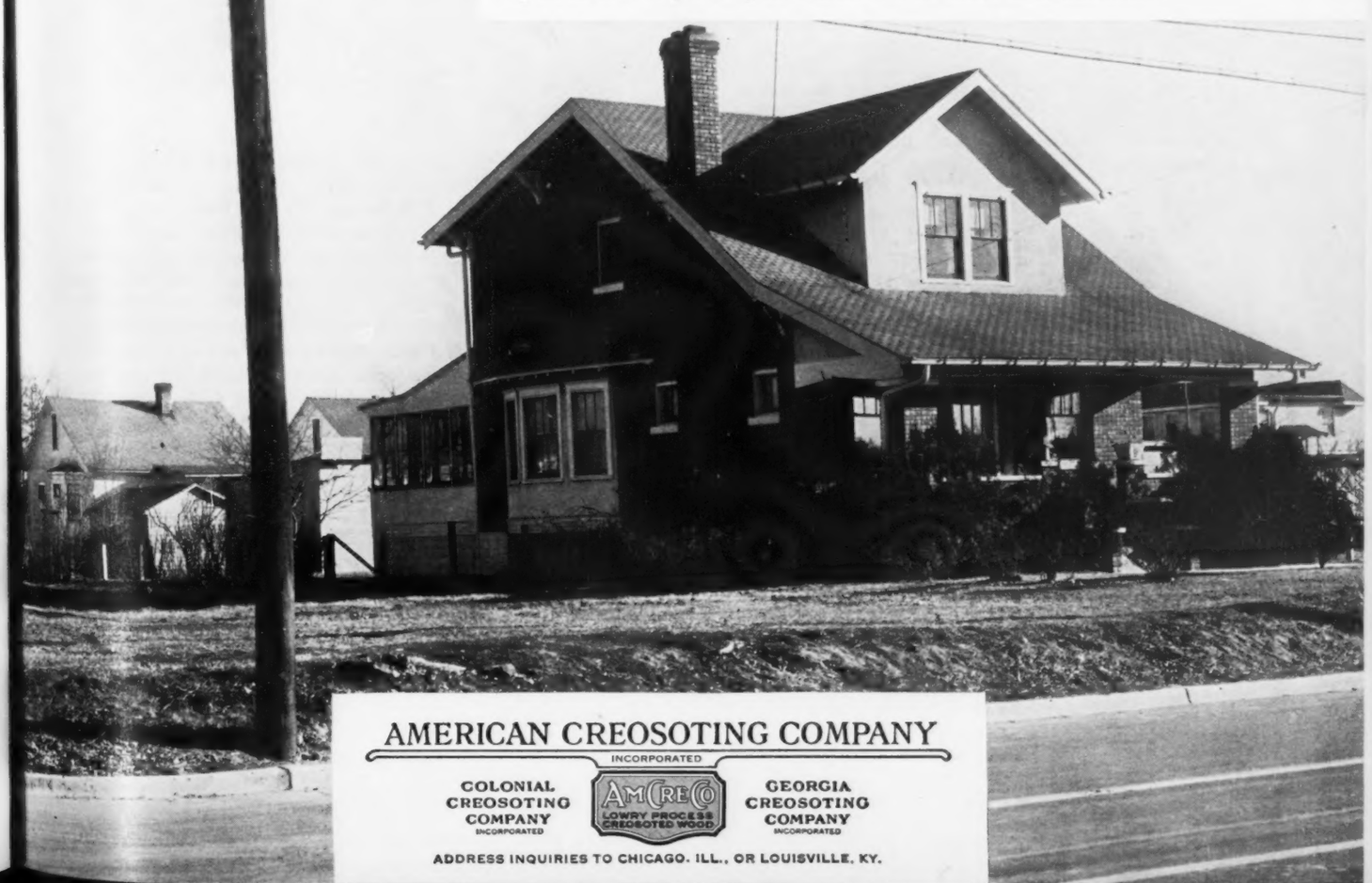
FULL LENGTH PRESSURE TREATED POLES

FROM power supply to the ultimate consumer, the maintainance of trouble-free service is essential. Utilities must provide for new customers and greater consumption by present users. AmCreCo full length pressure creosoted poles play an important part in the successful provision of this service—and with great economy.

American Creosoting Company uses only time-tested preservatives and proven methods. It is through this policy that an enviable reputation of low up-keep cost and reliability has been built. The experience of years behind AmCreCo creosoted products is your guarantee of utmost satisfaction.



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AMCRECO LOWRY PROCESS CREOSOTED WOOD

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since 1934. Prior to his association with Ohio Brass Company he was with the commercial engineering department of the Frigidaire Corporation.

•

Greist Company Appoints Baratelli Sales Director

Charles A. Baratelli has been appointed director of sales of the Greist Manufacturing Company, New Haven, Conn., to succeed WALTER LOWN, who has resigned to become associated with the Polaroid Corporation of Boston.

Mr. Baratelli, who has been assistant sales manager of the company since early in 1936, has a wealth of experience in the portable lamp field. He is credited with a major role in the engineering development of the Greist "White Knight," nationally advertised product of the company, and several other lighting innovations, as

well as assuming an important part in their sales promotion. Prior to his connection with Greist, Mr. Lown was widely known in the electrical field for his sales executive work with the Fitzgerald Manufacturing Company.

•

▶ ALBERT WEST has been appointed manager of the electric and water services of the Arkansas Power & Light Company at Batesville, Ark., to succeed E. H. Glenn, resigned. Mr. Glenn had been manager for the past fourteen years. He resigned from active service because of poor health.

▶ HAROLD SMITH, vice-president of the Westinghouse Electric & Manufacturing Company, has been awarded a parchment scroll by John W. Davis, chairman of the United Hospital Campaign, New York, in appreciation of his services rendered during the recent campaign. Mr. Smith acted as chairman of the electrical industries division of the industry section. FLOYD L. CARLISLE, chairman of the board of the Consolidated Edison Company, also received a scroll for his work as chairman of the public utilities division. Appointed by Walter C. Teagle, chairman of the industry section, Mr. Smith and Mr. Carlisle organized associates in their field to aid in the appeal.

▶ DR. WILLIS R. WHITNEY, vice-president of the General Electric Company, was elected a life member of the corporation of the Massachusetts Institute of Technology at a recent meeting.

▶ W. H. UDE has been appointed claim, tax and right-of-way agent for the Washington Water Power Company to succeed the late Col. Thomas G. Aston. Mr. Ude has been director of customer relations for the Spokane utility since 1923.

▶ JOSEPH E. SCHUMACHER has been named by Mayor Frank L. Shaw to succeed the late Dr. John R. Haynes as a member of the Los Angeles, Calif., Board of Water and Power Commissioners. Mr. Schumacher is one of the founders of the Schumacher Wall Board Corporation.

▶ F. R. LAWSON has recently joined the engineering department of the Pacific Gas & Electric Company, San Francisco, Calif.

▶ DAVID W. SKINNER has been named managing engineer of the appliance section of the General Electric Company by W. Stewart Clark, manager of the Bridgeport works. With this appointment Mr. Skinner becomes responsible for both engineering and manufacturing of the appliance section. He has been associated with General Electric since 1925.

▶ F. L. LAWTON, since 1930 an electrical engineer for the Saguenay Power Company, Ltd., Arvida, Que., Canada, recently became chief engineer of the company. A native of London, England, and a graduate of the University of Toronto, Mr. Lawton completed the test course of the General Electric Company, Schenectady, N. Y., and in 1924 was transferred to the general engineering department of that company. In 1925 he became assistant to the electrical engineer of the Quebec Development Company and during the following year was placed in charge of drafting for a hydro-electric survey. Later he was appointed assistant to the superintendent of operation, the position he held until 1930. In that year he became electrical engineer for the Duke-Price Power Company, Ltd., which later became the Saguenay Power Company, Ltd. Mr. Lawton is a member of the Engineering Institute of Canada.

International G.E. Elects Callahan Vice-President

Edward F. Callahan, general manager of apparatus sales of the International General Electric Company, has been elected a vice-president of the company. Mr. Callahan has been

in the employ of General Electric and the International General Electric for 33 years.

A native of New Haven, Conn., and a graduate of Yale University, he entered the test course of General Electric at Schenectady. In 1911 he joined the foreign department and seven years later was made assistant to E. A. Baldwin, manager of the Department of Europe, International General Electric Company. In 1922 he became sales manager of the Department of Americas, and four years later was named general manager of apparatus sales of I.G.E. Since 1931 Mr. Callahan's headquarters have been in New York.

OBITUARY

▶ JOHN B. MYERS, manager of the Bingham division of the Utah Power & Light Company since 1918, died last month, of pneumonia. He was 68 years of age. Though a native of Kentucky, Mr. Myers lived in Utah for 40 years. From 1908 to 1912 he served as chief electrician for the Knight Mining Company and the Knight Power Company at Eureka. He became Eureka division manager for the Utah company in 1913, serving in that capacity until his transfer to Bingham.

▶ J. G. MONAHAN, for the past 22 years district manager for the Sangamo Electric Company at Los Angeles, died at his home in Glendale, Calif., last month. Mr. Monahan began his business career in South Africa, where he represented the Ferranti Company until after the Boer War. After a brief

sojourn in England he went to Canada for six years, again representing Ferranti. He had been connected with Sangamo since 1914.

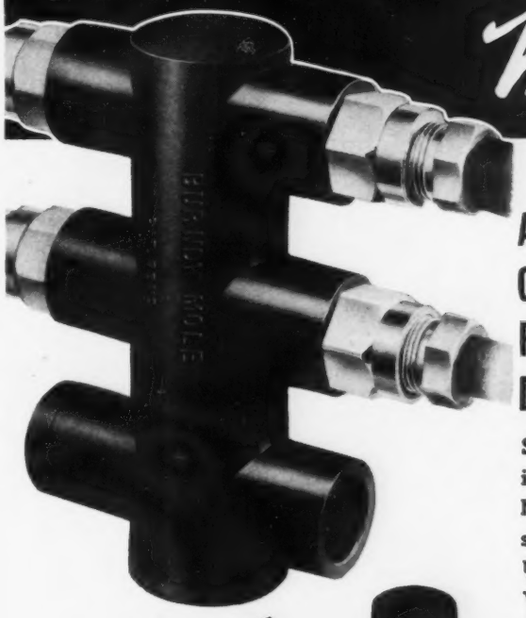
▶WILLIAM B. FOLLINE, electrical engineer, General Electric Company, Dallas, Tex., died November 25. In 1917 Mr. Folline entered the test course of the General Electric Company, Schenectady, N. Y., and in the following year he was transferred to the switchboard engineering department of that company. In 1921 he was transferred to the Dallas, Tex., offices of the General Electric Company and remained there for almost seventeen years.

▶ROBERT W. ROLLINS, JR., formerly New Orleans representative of the Automatic Refrigerating Company, Hartford, Conn., and then later connected with the merchandising department of the Worcester (Mass.) Electric Light Company as an electric refrigeration engineer, died suddenly at his home in Worcester on January 7 at the age of 47. At the time of his death he represented the Servel organization in Worcester County and also was engaged in air-conditioning sales in that area. He was a son of Robert W. Rollins, formerly general manager of the Hartford Electric Light Company and a former president of the Worcester Electric Light Company.

▶GEORGE R. WRIGHT, manager of the Canadian General Electric Company in British Columbia with headquarters in Vancouver, died recently at his home in that city, in his fifty-sixth year. Following graduation from McGill University in 1906, Mr. Wright joined the electrical engineering staff of the Canadian General Electric Company in Peterborough, Ont., and later was transferred to Toronto. He then went to Vancouver and in 1916 was named manager of the company's Manitoba division, with headquarters in Winnipeg. He remained in that position until 1925 when he returned to Vancouver.

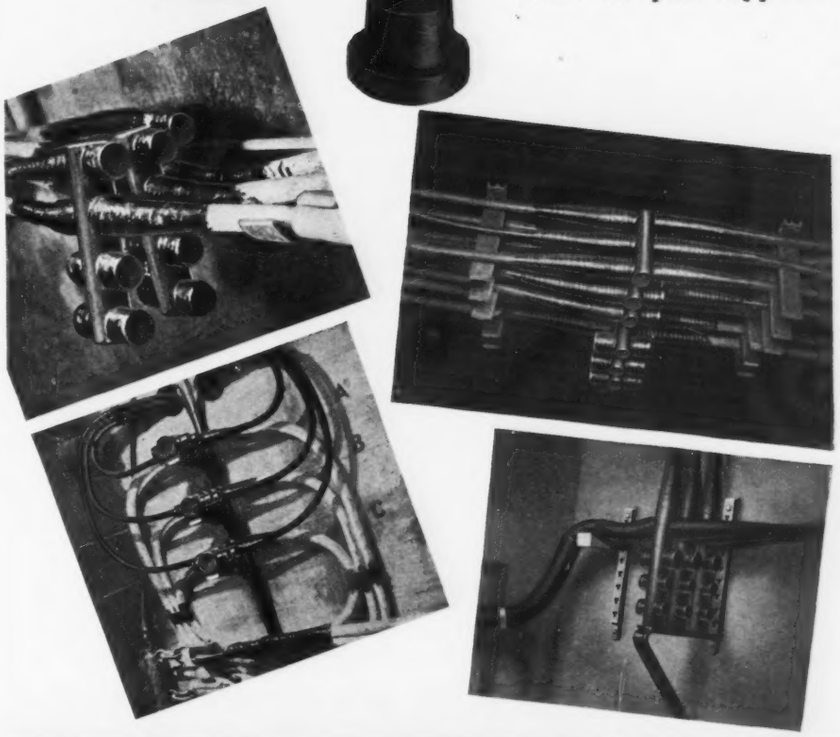
▶STANLEY B. ILER, who had been connected with the Ontario Hydro-Electric Power Commission since 1919, died December 10, in his fiftieth year. Mr. Iler obtained his early experience with the Canadian General Electric Company at Peterborough and with Smith, Kerry & Chase, Toronto. In 1912 he joined the staff of the Brantford Hydro-Electric System and later affiliated himself with an engineering firm in Edmonton, Alberta. Following the World War he entered the municipal engineering department of the commission, where he had served continuously as a district engineer in the eastern Ontario district.

The BURNDY Mole



A NETWORK CONNECTOR FOR UNDERGROUND DISTRIBUTION

Shown below are a few typical installations of the BURNDY MOLE — the completely insulated multiple tap. Catalog No. 787 contains full details. Write for your copy . . .



BURNDY
ENGINEERING CO., INC.
459 E. 133d St., NEW YORK, N.Y.

Manufacturing AND MARKETS

Big Rise Reported in Air Conditioning

A 50 per cent increase in business over 1936 made last year the best in the history of the heating, ventilating and air conditioning industries, David S. Boyden, president of the American Society of Heating and Ventilating Engineers, announced at the opening of the Fifth International Heating and Ventilating Exposition in Grand Central Palace in New York this week.

The show was held in conjunction with the forty-fourth annual meeting of the society in the Hotel Biltmore. More than 1,500 air conditioning engineers and technical experts in heating and ventilating attended the meeting.

"Upward of $100,000,000 of equipment for summer, winter and year-round air conditioning alone was sold last year," Mr. Boyden said, "and this does not include a vastly larger amount spent for heating systems in homes, large buildings and industrial plants, together with ventilating equipment of all kinds." He added that an even better year was expected in 1938.

•

Lets Contract for Plant

Sunlight Electrical Company, Warren, Ohio, has awarded a general contract to the National Concrete Fire Proofing Company, Cleveland, Ohio, for new plant on local site, to replace existing works, which have become too congested for desired production. The new plant will be one-story, 240 x 500 ft., totaling close to 120,000 sq.ft. of manufacturing area, and will practically double the present plant facilities. It will represent an investment of close to $500,000 with equipment.

•

Standard Electric Stove Corporation Reorganized

Standard Electric Manufacturing Corporation has been chartered with a capital of $19,500 of preferred and 19,805 shares of no par common stock, to acquire the assets of the Standard Electric Stove Company, Toledo. Standard Electric Stove was recently purchased by Joseph W. Robinson, who was president of the Libbey Glass Manufacturing Company until it was taken over by the Owens-Illinois Glass Company. Standard Electric Stove will be reorganized and probably a new and larger plant will be necessary for its operations, Mr. Robinson announced.

•

Copper Buying Light; Price of Wire Cut

Due to the slumping tendency in the non-ferrous metals, sales volume in all base metals was limited to small lots during the early part of the week. Apparently recent fluctuations in copper prices have failed to attract new purchasers.

General Cable Corporation, taking cognizance of the decline in the copper market, has proportionately adjusted its selling prices. It announced a reduction of 1 cent a pound in the base price of weatherproof wire, reflecting the cumulative decline in commodity prices other than metals. Anaconda Wire & Cable Company also reduced the price of weatherproof wire 1 cent a pound shortly after the announcement by General Cable.

•

British Trade Index Lower

The British Electrical and Allied Manufacturers' Association's index (1930=100) of new orders for November in the United Kingdom electrical trades, while unaltered when compared with October, last, was substantially below November, 1936. The index number was 143.0 for November, as against 166.3 for November, 1936, and 173.2 for October, 1936. The percentage of insured workers unemployed in November was 3.1, as compared with 3.0 per cent in October last and 3.4 per cent in November, 1936. For the year 1937 as a whole, however, a record volume of turnover is reported.

Trade Pact Lists Electric Products

The reciprocal trade agreement pending with the United Kingdom, Newfoundland and the British Colonial Empire involves a wide range of electrical products.

Paragraph 353, referred to as the "electrical paragraph" of the Tariff Act, reads as follows:

All articles suitable for producing, rectifying, modifying, controlling, or distributing electrical energy; electrical telegraph (including printing and typewriting), telephone signaling, radio, welding, ignition, wiring, therapeutic, and X-ray apparatus, instruments (other than laboratory), and devices; and articles having as an essential feature an electrical element or device, such as electric motors, fans, locomotives, portable tools, furnaces, heaters, ovens, ranges, washing machines, refrigerators, and signs: all the foregoing and parts thereof, finished or unfinished, wholly or in chief value of metal, and not specially provided for.

Other products listed include:

Mica plates and built up mica; carbons, electrodes, brushes; telephone, telegraph and other wires and cables; steam turbines and parts thereof; molded insulators and insulating material.

Electrical products may be involved under certain other paragraphs, including:

Copper, pewter, or silver-plated table, household, kitchen and hospital utensils; scientific and laboratory instruments, apparatus, etc., nautical instruments and parts; molded, pressed, or formed articles, in part of asbestos; manufactures of "hard rubber." The list also includes a wide range of machinery and manufactures.

Under the reciprocal trade agreement procedure, concessions in American duties may be as great as a 50 per cent reduction in the present rate. In this connection it is to be remembered that any concession made in this agreement will accrue to the benefit of all countries except (for the present) Germany and Australia.

•

Elliott Gets Turbine Award

Board of Public Works, Chillicothe, Mo., has awarded a contract to the Elliott Company, Pittsburgh, Pa., for

a 2,500-kw. steam turbo-generator unit and auxiliary equipment and for a 4,300-sq.ft. surface condenser, at a price of $94,650. This and other equipment will be installed by the municipality in connection with expansion and improvements in city-owned electric power plant.

It is expected to ask bids in February for new boiler unit, switchboard, instruments and other equipment, as well as for general contract for construction of addition. Entire project will cost approximately $300,000.

•

Manufacturers Make Sales Assignments

Among the electrical manufacturing companies which have recently made additions to their sales staffs are the following:

McGill Manufacturing Company has added R. C. Purdy to its Detroit sales force. Mr. Purdy is to be located in Cleveland and will cover Akron, Canton, Youngstown and Warren, Ohio.

John J. Massimi has been appointed manager of apartment house appliance sales to head the apartment house department recently established to handle the merchandising of Kelvinator household appliances in that field. Headquarters are in New York.

Mica Insulator Company announces the appointment of the Kirby Company, Cleveland, Ohio, as authorized fabricator of their "Lamicoid" (laminated bakelite) sheets, tubes and rods.

Bull Dog Electric Products Company, Ernest K. Higginbottom, district representative in the Atlanta territory. His appointment goes into effect February 1. Mr. Higginbottom will represent the company in South Carolina and in portions of Georgia, Florida and Alabama.

James Boyd, formerly assistant eastern district manager, has been appointed eastern district manager of Westinghouse Electric & Manufacturing Company. He succeeds H. F. Boe, who becomes commercial manager of the company with offices in Pittsburgh. Mr. Boyd's headquarters will be at 150 Broadway, New York.

•

Federal Supply Awards Let

Among the Federal supply contracts recently let are the following:

Victor Insulators, Inc., Victor, N. Y., War, bus insulators, $15,951.

General Cable Corporation, New York, War, cable and reels, $10,800.

New York Metal Prices

	Jan. 19, 1938 Cents per Pound	Jan. 25, 1938 Cents per Pound
Copper electrolytic	10.75*	10.25*
Lead Am. S. & R. price	4.90	4.90
Antimony	13.75	13.75
Nickel ingot	35.00	35.00
Zinc spot	5.35	5.35
Tin Straits	41.625	41.00
Aluminum, 99 per cent.	20.00	20.00

* Delivered Connecticut Valley.

Field Reports on Business

Industry is now looking toward Washington for some signs to revive business. The TVA decision has caused greater uncertainty among the utilities. As a result forward purchases have been curtailed to a minimum pending a clarification of the government's competitive power program.

NEW ENGLAND

Improvement in buying electrical equipment in this district during the past week is reported in the industrial departments of well-known manufacturers and the present month's sales volume, while lower than for a year ago, is not far from the average level maintained for the past four years. Small motor sales are decidedly better; several interesting orders for fair-sized groups ranging up to 50 motors are pending as a result of a resumption of activity among machine tool manufacturers in Massachusetts and Rhode Island.

Heavy electrical machinery is quiet, but inquiries for arc-welding equipment are increasing and interest in floodlighting is gaining, due in part to demand for lighted ski-ways. One large ski-runway has asked for quotations for immediate installation of a number of reflectors. Improvement of the Nantucket, Mass., airport at a cost of $14,454 offers prospects for the sale of these units.

Architects are asking for quotations on a considerable amount of wiring supplies for lighting and signaling systems in institutional buildings. Merchandise orders are scattered, but an encouraging start comparing favorably with the first month of last year is reported from the Vermont area.

The New Haven Railroad has announced plans for the expenditure of $2,100,000, which involves new air-conditioned passenger coaches and Diesel-powered switching engines, pending permission of the federal district court. A recent order received by General Electric calls for the construction of a number of small turbo-generators at the Lynn plant which are destined for naval use. The Eastern Massachusetts Electric Company plans to expend $65,000 for improvements in transmission facilities.

PACIFIC COAST

Except in the Pacific Northwest, where they registered a slight gain, the volume of Pacific Coast building permits during December averaged a 30 per cent decrease under those of November, 1937. The twelve months totals for 1937 indicated a 2 per cent increase for San Francisco over 1936 and increases of 1 per cent, 2 per cent and 4 per cent for Los Angeles, Salt Lake City and Seattle respectively, Portland showing the only decisive gain with 25 per cent.

Rural electrification activity includes a $208,730 bid for 250 miles in the Feather River Canyon area in northeastern California, a big job along the All American Canal around El Centro, requiring fifteen carloads of wire, 2,000 poles, 8,000 insulators and requisite hardware and a 77-mile, 370-customer line near Florence in Pinal County, Arizona.

Considerable private reconstruction in San Francisco is partially influenced by Exposition year preparation, such as a $200,000 addition to the Hearst building and jobs of $300,000 and $500,000 respectively for the Claus Spreckles building and the Empire Hotel, with much facading planned elsewhere. These structures, together with the relighting of a downtown department store, have created much lighting business in the Bay area, where 101 highway luminaires, costing $8,500, were recently installed on key highways and sodium units replaced incandescent lights in a vehicular tunnel.

Machinery sales, except in the Los Angeles district, are temporarily quiet, but bids are being received on a 150,000-hp. turbine governor and generator for Kendrick project in Wyoming and telephone carrier-current equipment for the Boulder plant.

NEW YORK

Purchases of equipment and stores by utilities have come to a standstill as a result of recent court decisions upholding the power program of the government. While the industry has budgeted expenditures for 1938 in excess of last year, very little buying has been made so far.

While the decision of the court in Chattanooga upholding the validity of the TVA had not been unexpected, the scope came as a surprise. It is felt in many quarters that the government is now free to exercise any type of competition with all business. Because of this feeling greater uncertainty and uneasiness exist.

There has been practically no change in business during the past week. Movement of goods is spotty, with buying held to a minimum. Observers believe that buying in great volume will come into the market in the spring. This is seen on the basis that inventories are being depleted and new stock must be ordered.

Business leaders are looking to Washington for some signs of what the future holds. So far nothing tangible has come out of the conferences between President Roosevelt and labor and industry leaders. Hope is expressed in many quarters that definite steps will be made to restore confidence and revive trade.

CHICAGO

Basic conditions in business remained practically unchanged during the week with trade in most quarters very spotty. Orders for electrical equipment are still running well under a year ago, although sentiment is that a pick-up is overdue. Inventories of electrical stocks are said to be not excessive, which has given rise to the belief and new orders should soon make their appearance in the markets.

Reports indicate that electric range sales are showing some improvement. Several large air-conditioning installations are being planned. Another item of note is the increasing number of high-intensity illuminated theater fronts being installed. On some of the jobs the connected load for the canopy alone is 80,000 watts.

The pick-up in steel operations and lifting of automobile production appear as outstanding favorable signs in reviving trade. There has been a stiffening of commodity prices of late, which has led many to believe that the bottom has been reached. It is felt that if present levels can be maintained a base will be formed for recovery.

Rx TIMELY IDEAS
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How?

Through increased electrical applications in production, assembly, handling, inspection.

Do these applications exist?

They do. All over the country individual plants are testing new uses of electric power —to cut their costs under present conditions—to save waste—to improve quality. In turn, each of these applications becomes a tested idea which many other industries can adapt to their own use. Great developments lie ahead in the market for electric power.

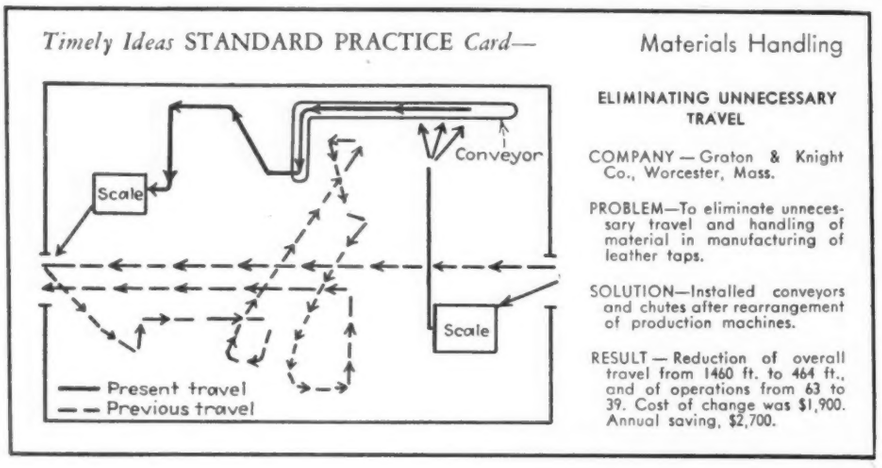
Is the information available?

Do you know that the best of these ideas are gathered regularly, compiled and published by McGraw-Hill Electrical Publications as a special service for you to distribute to your power customers?

In short, do you know TIMELY IDEAS—designed specifically for the needs of power sales departments in 1938?

It would cost you thousands of dollars to obtain and publish the material in a year's issues of TIMELY IDEAS. Yet you can purchase this service to distribute to all of the important people in the plants in your territory for a very moderate sum.

TIMELY IDEAS now in its third year has proved so useful and interesting that a large percentage of presidents, superintendents and officers in the plants of power users ask for it regularly—and electrical men eat it up.


Timely Ideas STANDARD PRACTICE *Card*—
Materials Handling
ELIMINATING UNNECESSARY TRAVEL
COMPANY — Graton & Knight Co., Worcester, Mass.
PROBLEM—To eliminate unnecessary travel and handling of material in manufacturing of leather taps.
SOLUTION—Installed conveyors and chutes after rearrangement of production machines.
RESULT — Reduction of overall travel from 1460 ft. to 464 ft., and of operations from 63 to 39. Cost of change was $1,900. Annual saving, $2,700.
Conveyor
Scale
Scale
Present travel
Previous travel

The STANDARD PRACTICE Card—One of the new features in TIMELY IDEAS

★ To commercial managers and lighting specialists. The TIMELY IDEAS organization also produces a companion service to assist in load building with commercial customers. Ask for a sample copy of TIMELY IDEAS FOR PROFITS.

power sales in 1938

SIMMONS COMPANY NOW DOES THIS JOB AUTOMATICALLY
An Example of Elim
Motions and Oper
"MINIATURE RAILROAD" IN WAREHOUSE
LIGHTING INCREASES SPEED OF REPETITIVE OFFICE OPERATIONS
HEAT MUST BE UP IN ONE MINUTE
"In our plant 150-lb. cylind
HOW WE IMPROVED A FINISHING OPERATION
Mr. M. L. Foskat
SIMPLIFYING DEFROSTING
Ice had to be chipped from
HOW LIGHTING A LONG NARROW AISLE
ELIMINATED A CHANCE COSTLY MISTAKES
A FORMULA FOR ELIMINATING WASTE MOTIONS IN AS
BOARD OF TRADE'S EXI
HOW QUICKLY CAN YOU KILL A PLANT FOG?
KILLING THAT THREE-O'CLOCK INSPECTION SLUMP
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Maintenance

A few of the case studies in the winter issue—now available.

IF you are not one of the seventy power companies now profiting from the use of TIMELY IDEAS — check now for 1938 load building.

Send the coupon on this page for a free sample copy of the winter issue—a special collection of case studies on reduced operating costs.

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☐ 25 cents in stamps enclosed.

Name ..... *Title* .....

Company .....

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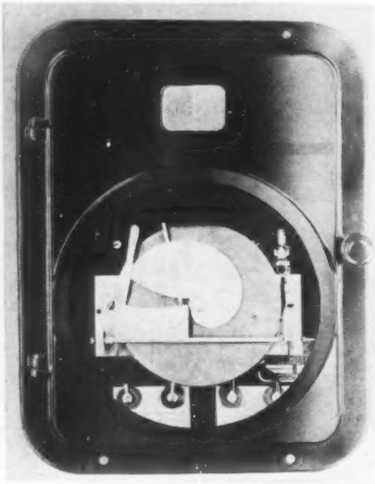
New EQUIPMENT AVAILABLE

Power Telemetering

This company's telemetering instruments have been adapted recently to the measuring and transmitting of electrical quantities, such as volts, amperes and watts. It



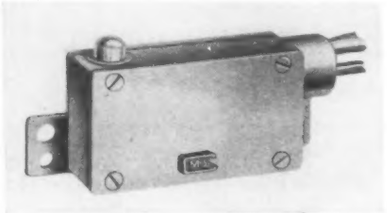
"Metameter." **The Bristol Co.**, Waterbury, Conn.

is said they will handle measurements of all magnitudes, from milli-voltages up to the totalized output of power plants. As in similar types for telemetering pressure, flow, temperature and other non-electrical quantities, a cam, driven by a constant-speed motor, gives the electrical impulses necessary to operate the system. This device is designed periodically to engage and release pointer arm of the measuring element, so that no strain will be placed on the element.

•

Limit Switch

Snap point of this compact precision limit switch is held in close tolerance relation to dowel holes in the mounting plate. This feature is said often to eliminate the necessity for adjustability of actuating parts and to make available the economy of setting to jig. Switch is sealed in steel case and actuated by a plunger, sealed against entrance of normal oil and water. Plunger has total travel of ¼ in., but switch is actuated by movement of 0.001 in. in forepart of travel.



"L-K" switch; 2¾ x 1 9/16 x 15/16 in.; rated at ½ hp., up to 460 volts a.c. **Micro Switch Corp.**, Freeport, Ill.

•

Clip-On Ammeters

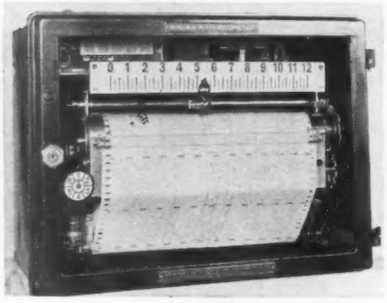
"Ferranti" dual range clip-on ammeters; ten models provide ranges of from 0 to 250 amp. low range scales, 0 to 1,500 amp. high range scales. **Ferranti Electric, Inc.**, New York, N. Y.

With the recent addition of three dual range combination models, this company's line of clip-on ammeters now totals ten, each instrument having two full scales. Range of instrument is changed instantly at touch of switch immediately above the dial. As their name suggests, these instruments indicate current when clipped around the conductor, insulated or non-insulated.

•

Numeral Print Recorder

Two to six temperatures from as many different thermocouples may be continuously recorded using this multiple recording potentiometer pyrometer. Only one



Multiple recording potentiometer pyrometer; uses 12-in. chart. **Brown Instrument Co.**, Philadelphia, Pa.

symbol, a plus sign, is used, a multi-color numeral identifying the thermocouple from which the temperature record is being made. Vertical line of the plus sign indicates temperature and horizontal line time co ordinate, the intersection locating the point of the time-temperature record.

•

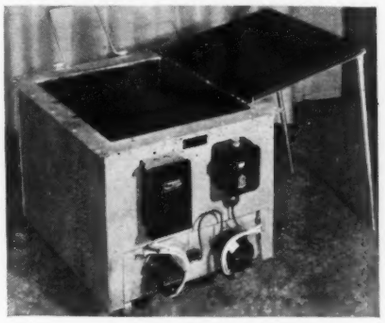
Service Entrance Connectors

Service entrance connectors; to handle B. & S. wire sizes 4 and 6 or 6 and 8. **W. N. Matthews Corp.**, St. Louis, Mo.

Service entrance connectors for house service connections or other small solderless wire connections are latest additions to this company's line. Body is one-piece, hard-drawn copper; bolt is of Everdur, with slotted hex head, so that either wrench or screwdriver may be used. Inside body wall is threaded to give greater strength and locking against vibration.

Heat-Treating Tank

Two electric immersion heating elements, each 4½ kw., together with control bulb of automatic temperature controller, are installed symmetrically in bottom of this insulated heat-treating tank. Heaters are balanced three-phase types;



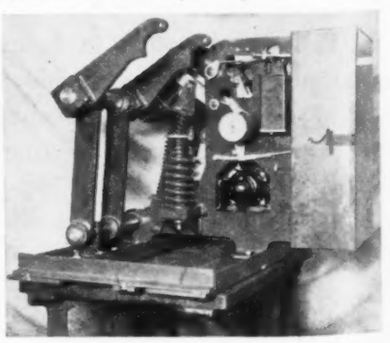
Heat-treating tank; developed for treating leather products in oil at 300 deg. F.; may be made for other temperature requirements or products. **Herrington & Randall, Inc.**, Detroit, Mich.

both they and the control bulb are protected by removable expanded metal guard which also serves as rest for holding work. Control instrument operates on relay and contactor to maintain desired temperature, the latter being readily adjusted from the outside of tank. Tank may be stationary or portable.

•

Circuit Breaker Mechanism

A motor-driven cam device has been developed to supersede the centrifugal motor mechanism formerly used to operate this company's Type FH oil-blast circuit breakers and takes four inches less headroom. Cam acts against a roller connected to a standard trip-free linkage. At the end of the closing stroke, the motor is electrically disconnected, excess energy of cam is absorbed by dashpot and cam is



Type ME-10 circuit breaker mechanism; for Type FH oil circuit breakers. **General Electric Co.**, Schenectady, N. Y.

returned to starting position by spring. Definite proportioning of closing force to closing requirements of breaker is said to provide high-speed closing without undue shock or over-travel at end of stroke.

•

Dead-End Tool

Heavy duty dead-end tool; to handle conductor tensions up to 10,000 lb. **James R. Kearney Corp.**, St. Louis, Mo.

This company has announced a new heavy-duty dead-end tool said to be adaptable to various types of strain insulator construction on wood pole line structures and steel tower transmission systems. Light in weight, it may readily be installed and handled by two men.

•

Motor-Driven Cable Reel

This motor-driven reel, to wind rubber cable, may be set in any position, is inverted as illustrated to utilize a cable one-half the length of the run. Thus a 500-ft. cable serves a 1,000-ft. run. Cable voltage may be 2,300 volts, with ground wires in the cable on any lower voltage. Motors are 600 volts or less, a.c. or d.c.

Style 2 motor-driven reel; shown with 250 ft. No. 4 cable. **J. L. Gleason & Co.**, Cambridge, Mass.

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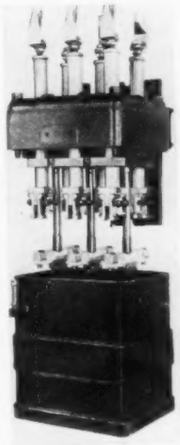
Indoor Breaker



Expulsion ports to hasten arc extinction are featured in this moderate capacity indoor oil circuit breaker. In addition to non-oil-throwing construction, the breaker features self-aligning, wedge-and-finger type contacts with silver surfaces on main contacts, electrically-welded steel tank, one-piece Bakelite bushings, flat angle, straight-line-motion type mechanism.

Type DX-25 indoor oil circuit breaker; manually or electrically operated for 600, 1,200 and 2,000 amp. at 15,000, 7,500 and 5,000 volts, respectively; interrupting capacity, 75,000 kva. **Allis-Chalmers Mfg. Co.**, Condit Works, Boston, Mass.

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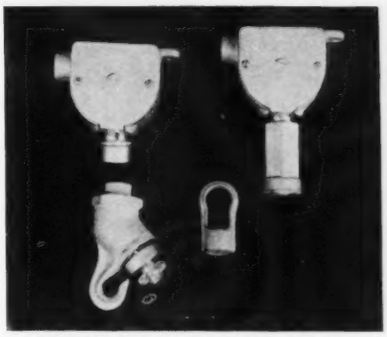
Electric Fixture Hangers

Two new types of malleable electric fixture hangers for use in wiring and hanging industrial units contain a universal joint allowing the pendant to swing



Malleable iron electric fixture hangers; for sodium-vapor and mercury-vapor as well as other industrial lighting units. **Thomas & Betts Co.**, Elizabeth, New Jersey.

freely 18 deg. in any direction. Known as the "ball" and the "cushion" types, they are similar, the latter containing a spring or cushion that supports the fixture and absorbs shocks caused by vibration or other factors. Suspending hook containing a wired receptacle and receiving a loop provides a method for hanging the lighting fixture.

•

Heat Controls

Model VD-2; may be set for temperatures from 0 to 1,400 deg. F.; snap-action switches rated at 10 amp., 110 volts; 5 amp., 220 volts or 3 amp., 440 volts, a.c. **Burlington Instrument Co.**, Newark, N. J.

Latest addition to this company's line of temperature controls has two snap-action switches instead of one, making possible a two- or three-step heat control. Each switch has its separate adjusting screw; there is also a main adjusting lever with screw and dial. Either or both the switches may be normally open, normally closed or three wire, single pole, double throw, making possible a wider number of applications for industrial heating. Thus, with one normally closed and one normally open type, first switch could control temperature, the second be arranged to give a high temperature alarm.

•

Fiber Lamp Guard

"C. & E. Fiber Guard, No. 114"; for 50- and 75-watt lamps. **Ericson Mfg. Co.**, Cleveland, Ohio.

Designed to protect the user and electrical machinery that would be damaged by accidental shorts caused by metal guards. This guard is constructed with six fiber strips and one band around the center, has a heavy vulcanized fiber swivel hook, full-length half reflector covered on the inside with a white baked enamel. Guard is sprayed with steam lacquer to make it moisture-proof, has a tensile strength of 6,000 lb. per sq.in. and crushing strength of 40,000 lb. per sq.in.

•

Belt Vulcanizer

Both the upper and lower platens of this belt vulcanizer are heated, to lessen vulcanizing time. It is sufficiently light in weight so that it may be used on belts which are in place on the machines or to be used on a bench, with the belt brought to it. The top platen is mechanically hinged, rather than being loose or apart from the rest of the plate. In use, the upper platen is swung edgewise off from the lower, the lapped ends of the belt, with the cement applied, laid on the lower platen and the upper platen

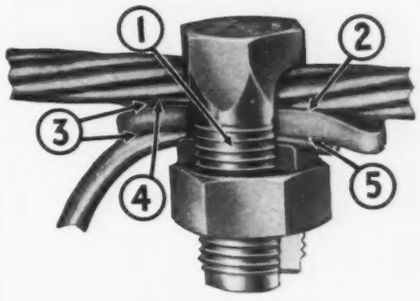
Here is a typical example of the attention to detail found in

RELIABLE

engineering

•

Aluminum to Copper Connectors



Features

• 1. Perfect fit, accurately machined threads apply high pressure to joint.

• 2. High pressure is distributed over large area of aluminum to prevent appreciable cold flow and consequent loosening after connector is applied.

• 3. Copper and aluminum wires are well separated—a drop of water cannot bridge them and eat the line wire.

• 4. Surface of spacer slug is hot tinned to give weather resisting coating and galvanized to prevent galvanic action with aluminum.

• 5. The portion of spacer that contacts the copper tap wire is plain copper.

Here's an important contribution to the field of solderless connectors for aluminum to copper.

Write for Sample. Test its performance.

Distributed and guaranteed by GraybaR ELECTRIC COMPANY

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES

—made possible about $30,000 worth of business in one year!

MIDGET "MEGGER" TESTER

Just 18 months ago an up-and-coming electrical contractor in New England purchased one of our $80 Midget "Megger" Testers, and now he writes:

"Regarding the Midget 'Megger', it seems strange that we were ever able to do business without it. We use it on practically every job that comes into our shop, and always on the premises of our customers. It has stood up beautifully and does more work than any other tool we have. Through its use it made possible about $30,000 worth of rewiring during this past year. We are able to show our customers grounded conditions, whereas before, we could only tell them of the bad conditions that existed. They like to see the instrument work, and many of them desire to use it. It is most convincing and does a beautiful job."

This is typical of what our "Megger" Insulation Testing Instruments are doing for electrical men "everywhere"—especially those who have discovered how simple it is to forestall electrical trouble in this way. Write for illustrated Bulletin 1355-W which describes various types of the "Megger" Insulation Testing Instruments up to 10,000 megohms and 2500 volts.

JAMES G. BIDDLE CO.

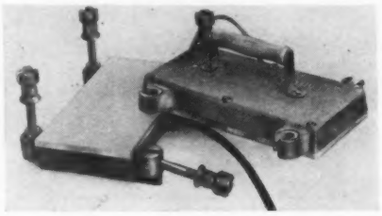
ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

Other Biddle Specialties:

"Megger" Ground Testers
"Megger" Direct-Reading Ohmmeters
"Megger" Capacitance Meter
"Ducter" Low Resistance Testing Sets
"Dionic" Water Tester
"Frahm" Vibrating-Reed Tachometers and Frequency Meters
"Jagabi" Rheostats
"Jagabi" Speed-Measuring Instruments

swung back into position and the four nuts tightened to provide the clamping pressure. It heats in 30 to 35 minutes, uses a thermostat to keep proper vulcanizing temperature.



"Ton-Tex" belt vulcanizer; for fabric, rubber or "Ton-Tex" belts; 1,000 watts, 110 volts, a.c. or d.c.; handles 7-in. belts in one operation; 10-in. belts in two. **Ton-Tex Corp.**, New York, N. Y.

•

Developing Machine

Developing speeds up to 16 ft. a minute are said to be obtained with a new developing machine which also permits use of sheets cut to the standard sizes of the originals. The accompanying illustration shows

"Type 3500" developer; in two sizes for prints up to and including 42- and 54-in. in width. **Ozalid Corp.**, New York City.

the printer properly positioned under the extending conveyor of the developer. Operator, standing in front of the printer, either feeds the exposed cut sheets into the conveyor or, when developing continuous yardage, starts beginning of the exposed roll under the belt which automatically carries the material along the conveyor, through developer and onto trimming table at rear.

• •

Oil-Tight Limit Switch

CR9440-B1B oil-tight "Alnico" snap-action limit switch. **General Electric Co.**, Schenectady, N. Y.

New oil-tight, snap-action limit switch is suggested for machinery where a small, compact, heavy-duty reversing limit switch is required to open or close a control circuit. Of single-pole, double-throw design, the switch has silver-faced tips on both stationary and moving contacts. Protection of the switch from oil is obtained by inclosing switch in a steel-inclosing case with two gasketed sides and an opening in the rear for ½-in. conduit connections. Movable contact assembly is held in position by a small "Alnico" magnet acting on an iron yoke. As yoke is broken away from magnet face by direct mechanical action of operating lever spring snaps contact assembly to opposite position, where it is held in by magnet until yoke is again broken away.

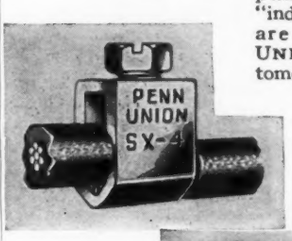
You're sure it's *Dependable*—

if it's a PENN-UNION conductor fitting—

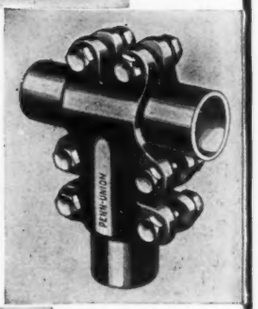
Every item carefully designed, and thoroughly tested.

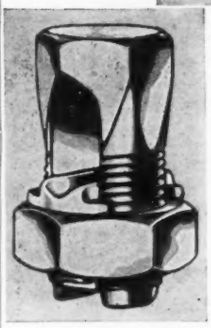
Never any question as to reliability of the connection—mechanically and electrically.

That's why the leading utility companies and "industrials" are PENN-UNION customers.



More than 6,200 items





The line is complete.

Fittings for every type of electrical connection.

Any combination of tube, bar, cable and wire.

Write for catalog.

Sold by leading jobbers

PENN-UNION ELECTRIC CORPORATION
ERIE, PA.

You'll find it in the *complete* line—

PENN• UNION
Conductor Fittings

Recent Rate Changes

SOUTHWESTERN GAS & ELECTRIC COMPANY has been ordered by the Louisiana Public Service Commission to scale down its rate schedule for electricity to effect an annual saving of $135,000 to consumers in Shreveport and vicinity. The commission did not specify in its order how the Southwestern company is to reduce its rates, merely stipulating that a reduction of that amount shall be made effective with March 1 billings. Twenty-five other utility companies of Louisiana have been cited by the commission to show cause why their rates should not be reduced.

CENTRAL ARIZONA LIGHT & POWER COMPANY has filed a new schedule of electric rates with the Arizona Corporation Commission which will reduce charges in Phoenix $200,000 a year. Electricity bills submitted after February 1 to approximately 25,000 consumers residing in Phoenix, Glendale, Peoria, Buckeye, Tempe, Gilbert, Chandler and all parts of the Salt River valley, will be lowered by the new rates.

COLUMBUS & SOUTHERN OHIO ELECTRIC COMPANY has offered to reduce its residential light rates 6½ per cent, a total of $151,000 a year. B. W. Marr, president, proposed the reduction on condition that City Council will approve a five-year contract and submit it to the electorate. The proposed residential rate is: first 10 kw.-hr., 5 cents; next 40 kw.hr., 4½ cents; next 100 kw-hr., 4 cents; over 150 kw.hr., 3 cents. The present rate is: first 30 kw.-hr., 5 cents; next 60 kw.-hr., 4½ cents; next 60 kw.-hr., 4 cents, over 150 kw.-hr., 3 cents.

ILLINOIS COMMERCE COMMISSION has announced that electric rate reductions during 1937 amounted to $1,571,336. Included are Central Illinois Public Service, $150,000; Public Service Company of Northern Illinois, $649,000; Central Illinois Electric & Gas Company, $255,036; Mt. Carmel Public Utility & Service Company, $10,000; Illinois Northern Utilities Company, $41,800; and Illinois Iowa Power Company, $467,500.

NEW YORK POWER & LIGHT CORPORATION has filed revisions of its electric rates with the Public Service Commission which reduce one power and two general rates in the city of Hudson and numerous villages and towns in Columbia and Rensselaer counties. The changes are estimated to save consumers in this area about $9,700 annually.

•

Hardy Plant Checks Erosion

A hardy plant known as the kudzu vine, imported years ago from Japan, has been found useful by the Alabama Power Company in checking sheet and gully erosion around transmission line structures and elsewhere on its properties, stated Gomer Evans, forester. The plant produces a rich foliage with a tough, fibrous vine which checks erosion in a remarkably short time. The U. S. Department of Agriculture encourages kudzu planting to check farm erosion.

INSULATION HEADQUARTERS

Be an INSULATION EXPERT In 3 Easy Lessons

Every practical designer, engineer and shop man knows, of course, that it can't be done, so why spend a lot of your valuable time trying to determine the right insulation for each particular application. That's our job! The experience of service engineers and laboratory men who have been specializing only in insulation is at your disposal without cost or obligation. Let us study your problem so that we can suggest a material that will improve product performance, or reduce manufacturing costs, or both. A letter will make the next move ours.

CONTINENTAL-DIAMOND FIBRE CO.

Newark, Delaware

Represented in Canada by DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO

DILECTO

A laminated plastic, commonly known as phenol fibre, made in sheets, rods and tubes or fabricated parts to specifications. Has high electrical insulation properties, great resistance to water, practically unaffected by oil or mild acids. It is a strong, tough material with a wide application for use in connection with modern electrical appliances.

DIAMOND VULCANIZED FIBRE

A tough, economical, insulating material made in standard sheets, rods and tubes. Can be readily fabricated or formed. A material of countless applications.

VULCOID

A thermo-plastic, non-hygroscopic insulating material made in standard sheets, rods and tubes. It is strong and tough, has good electrical insulating properties and is readily fabricated.

MICABOND

Thin splittings of mica bonded together with specially developed binders into standard plates, tubing or in formed rings, punched and sawed segments or other special parts. Micabond has high dielectric strength, is practically unaffected by acids, has high heat and moisture resistance, is readily punched, sawed or formed.

CELLULAK

A laminated form of insulating tubing, possessing extremely high dielectric properties, and marked resistance to flash-over.

DILOPHANE

A translucent, laminated plastic in colors. It provides perfect light diffusion, is not inflammable, and is manufactured in practically any color imaginable with either a glossy or dull finish.

Slater Lamps

UTILITIES
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ALL REPORT
Excellent Service
FULL LIFE FULL LIGHT GREATER ECONOMY

They find in SLATER lamps high uniform QUALITY . . . obtained by STEP-BY-STEP control . . . and in spite of SLATER extra supervision and test, the lamps cost less to buy, and far less in eventual cost.

HIGH QUALITY . . . MAINTAINED . . . means CONTINUED satisfaction

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DISTRIBUTORS:
A special offer (write for it) makes SLATER lamps a highly profitable line for you.

SLATER
ELECTRIC & MFG. CO., INC.
291 ADAMS STREET
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Sales Opportunities

ASHLAND, KY.—American Rolling Mill Company, Middletown, Ohio, plans installation of motors and controls, electric hoists, conveyors and other equipment in connection with expansion and improvements at branch plant at Ashland. Cost about $175,000. Work will be placed under way at once. F. E. Vigor is local manager.

ST. ANTHONY, IDAHO—Common Council is considering new municipal hydroelectric generating plant on Henry's Fork of Snake River, with transmission line to city, where power substation will be constructed. Application has been made to State Reclamation Department for permission to use water for station. Cost estimated close to $165,000. A. G. Miller, Mayor, is active in project.

MASON CITY, IOWA—Peoples Gas & Electric Company plans extensions and improvements in local steam-electric generating station. including installation of additional equipment for increased capacity. Company also plans extensions in primary and secondary lines in rural areas, totaling about 60 miles. Work will be carried out as part of 1938 expansion and improvement program. Fund of $300,000 is being arranged for projects noted and for betterments in gas system.

COLUMBUS, OHIO—Columbus & Southern Ohio Electric Company has plans under way for expansion in main steam-electric generating plant, with installation of new turbo-generator units and auxiliary equipment, high-pressure boilers and accessory apparatus to increase capacity about 30,000 kw. Cost estimated at close to $5,000,000. Work is scheduled to be carried out during present year.

CHATTANOOGA, TENN.—Welding Gas Products Company, Inc., care of M. E. White, 200 East Minnesota Avenue, Knoxville, Tenn., president, recently organized, plans installation of motors and controls, air compresors, conveyors and other equipment in new plant at Chattanooga for production of industrial oxygen and other industrial gases. Site is being selected. Cost about $100,000. J. D. Williams, Chattanooga, is vice-president and general manager.

BROOKLYN, N. Y.—Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, receives bids until February 7 for 2,000 to 5,000 miles of wire (Circular 108).

KENDALLVILLE, IND.—Is considering extensions and improvements in municipal power plant, to include installation of new 1,500 kw. turbo-generator unit and auxiliary equipment. Estimates of cost are being made. S. R. Ludlow, superintendent of municipal light and water plant, is in charge.

KALAMAZOO, MICH.—Has plans nearing completion for proposed addition to municipal electric power plant, with installation of equipment for increased capacity. Cost estimated close to $275,000. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

GLENWOOD CITY, WIS.—St. Croix County Electric Co-Operative, Inc., Glenwood City. William Rutzen, president, has plans under way for primary and secondary lines for rural electric system in parts of St. Croix and neighboring counties, totaling about 270 miles, with outdoor power substations and service facilities. Cost about $270,000. Financing will be carried out through federal aid. E. B. Wayts, Tenney Building, Madison, Wis., chief engineer, Wisconsin Rural Electrification Administration, is in charge.

CHINO, CALIF.—Southern California Edison Company, Los Angeles, Calif., has plans nearing completion for new addition to power substation at Chino, 40 x 40 feet, to include installation of transformers and auxiliary equipment. Company will also make improvements in power substations at Pasadena and Santa Barbara, Calif., with installation of additional equipment for replacements and increased output.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until February 4 for ventilating fans, controllers and spare parts for Portsmouth and Mare Island Navy Yard (Schedule 2642).

AVIS, PA.—Jersey Shore Steel Company, Avis, recently organized, plans installation of heavy-duty motors and controls, regulators, electric hoists, conveyors and other equipment in connection with expansion and improvements in former local steel mill, lately acquired, to be modernized for new plant. Project is scheduled for completion in about 90 days and will cost close to $200,000. John A. Shultz, formerly head of Sweet's Steel Company, Williamsport, Pa., is president.

SIDNEY, MONT.—State Water Conservation Board, Capitol Building, Helena, Mont., E. B. Donohue, chief engineer, plans power substation with three main transformers, switchgear and accessory equipment, and about 12 miles of transmission lines in connection with reclamation project in Richland County, vicinity of Sidney. Also will install five main motor-driven pumping units, two of 4,500 gallons per minute capacity, two of 6,750 gal. per minute rating and one of 7,200 gal. per minute capacity. Entire project will cost close to $100,000. Bids will be asked soon.

LAWRENCE, NEB.—Southern Nebraska Power Company, Superior, Neb., plans new transmission line from Lawrence to vicinity of St. Stephens Church, Neb. Permission has been secured.

KANSAS CITY, MO.—Kansas City Power & Light Company has plans under way for extensions and improvements in main steam-electric generating plant, including installation of new turbo-generator unit of about 25,000-kw. capacity, high-pressure boilers and auxiliary equipment. Entire project will cost close to $3,000,000 and will be carried out as a part of 1938 expansion and improvement program.

LINDEN, N. J.—General Motors Corporation, Linden Division, plans installation of motors and controls, conveyors and other equipment in new one-story addition to local automobile assembling works, for which superstructure will begin soon. Cost close to $100,000. W. S. Roberts is general manager at plant.

MARE ISLAND, CALIF.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids until February 16 for motor-driven pumping units, with controls and accessories, and for air-conditioning equipment for dry dock at navy yard, Mare Island (Specifications 8516).

LENOIR CITY, TENN.—Plans municipal electric distributing system using TVA power. Special election has been called February 2 to approve bonds for project. Financing in amount of $55,000 will be arranged through federal aid.

Municipal Plants

MENOMINEE, MICH.—Federal Judge Fred M. Raymond of Grand Rapids has dismissed the bill of complaint of the Menominee & Marinette Light & Traction Company to prevent the city from using PWA funds for financing a power plant. The order followed a ruling of the U. S. Supreme Court which upheld the government in the making of loans and grants for publicly owned electric plants.

YORK, NEB.—Petitions asking city council to submit to the voters a proposal for the acquisition of a municipally owned light and power plant are being circulated. Upon insistant demand for lower rates, the council last August indefinitely tabled a proposed five-year contract with the Iowa-Nebraska Light & Power Company.

COLUMBUS, OHIO—Construction of a $1,000,000 extension to the municipal light plant will begin as soon as City Attorney John L. Davies obtains dismissal of an injunction suit in federal court obtained by the Columbus and Southern Ohio Electric Company, forbidding the city to proceed with the work. The utility company obtained an injunction restraining the city from building, holding that the act granting the city federal funds was unconstitutional. The extension in Columbus calls for a new building just east of the present plant, new boilers, generating units, and other facilities that would permit the plant to carry the full burden of supplying power for the city's new $3,700,000 sewage disposal plant and provide more energy for street lighting.

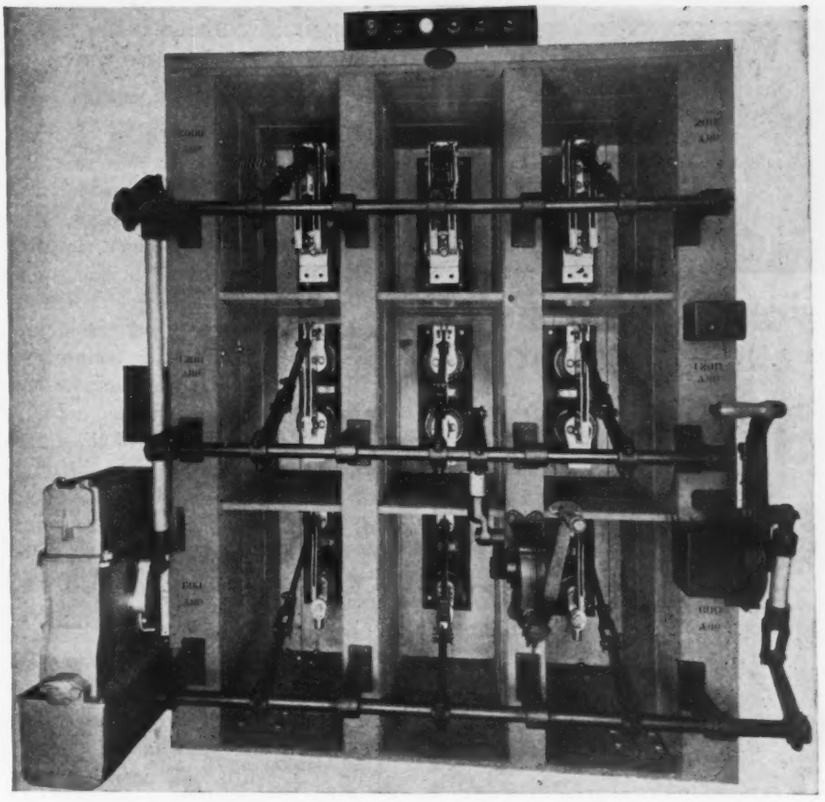
M'KENZIE, TENN.—An election authorizing a bond issue for purchase and construction of a distributing plant for TVA power has been voted by City Council. A date for the election and the amount of the bond issue will be determined later.

SUPERIOR, WIS.—State Public Service Commission has announced that on its own motion it would reopen the Superior Water, Light & Power Company acquisition case to consider a revaluation. A hearing will be scheduled soon. Taxpayer's suit, which was scheduled to be heard in Dane County circuit court this month has been deferred. The commission will investigate several problems in connection with the acquisition proceedings which have arisen since August 13 when it set a valuation of $4,625,000 for the water and electric utilities of the Superior Water, Light & Power Company. At a special session held recently, the city council gave first reading to a motion to repeal the $6,000,000 bond ordinance to purchase the utility. Webb Monaghan, who introduced the resolution, said that the ordinance should be repealed to leave the way clear for a new ordinance if the state public service commission set a new valuation.

•

Contracts Up 34 Per Cent

Public utility contracts let during 1937 totaled $277,730,100, a gain of 34 per cent over last year, according to an announcement by T. S. Holdon, vice-president of F. W. Dodge Corporation.



Safety:

—illustrated by three types of group-operated, 3-pole indoor disconnecting switches in the Elpeco Showroom:

TOP ROW
2000 ampere operated by motor mechanism

MIDDLE ROW
1200 ampere, operated by worm and wheel manual mechanism

BOTTOM ROW
600 ampere, operated by manual lever.

Can be furnished in various capacities and voltages. Essentially a safety switch, incorporating modern practice in safe operation. Many designs available to fit all switching conditions.

•

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COPPER
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SOLID & STRANDED WIRES

MEMCO ENGINEERING & MANUFACTURING CO.
LONG ISLAND CITY, N. Y.

SPLICING SLEEVES

Energized Substation Raised Above Flood Level

[*Continued from page 31*]

terial for future handling of transformers and the reduction in transportation hazard were considered.

Accordingly, new permanent handling tracks at transformer elevation and a removable steel bridge, to be handled by the Browning crane, were installed to permit direct transfer of transformers from rail connections or power house to the foundations. During installation it was actually necessary to return one of the transformers to the power house after it had been placed on the foundation; the saving in this case alone offset any difference that might have existed in handling costs.

All 60-cycle transformers at this station were untanked and inspected during this period, soldered connections were brazed, winding impulse strength in the older units was improved by the installation of adequate ratio adjusters, bushings were modernized, oil leaks eliminated and magnetic gages installed. It is interesting to note that one of these transformers had operated satisfactorily for probably five years or more after high-tension and intermediate insulation cylinders had been punctured by lightning. This condition and a defective soldered joint in another unit were discovered during the rehabilitation work.

As a result of the water damage to the transformers caused by the failure of permanent oil piping and valves when the units overturned, connection between the oil headers in the yard and the valves on the transformers will be made in the future through portable metallic hose.

Strong fire walls installed

Reinforced concrete and heavy brick fire walls have been added between transformers and reinforced concrete fire barriers 12 in. thick erected between the lower and upper stations to reduce the fire hazard, always present where large numbers of oil-filled units are installed. Surfaces below transformers are adequately drained. Where possible, crushed rock is installed below oil-filled units.

All transformers are now protected with water spray fire protective installations. In the upper yard, where the problem is particularly acute, water is applied at the high initial pressure of 150 lb. per square inch. This is obtained from two accumulator tanks containing a total of 2,000 gal. of water charged with station air to the required pressure. Discharge from these tanks continues for approximately two minutes, after which time water from the station mains is automatically admitted into the protective piping. Transformer water spray equipment is controlled manually from an operating center in the hydro plant.

Small Customer Demand Metering Improved

[*Continued from page 29*]

and amount of demand. Such an attachment as a part of a sweephand register has been the subject of considerable study by the author and will be shortly presented to the meter manufacturers for their consideration.

In order to assure satisfactory operation of sweephand demand registers in service, either of the cumulative or non-cumulative design, their mechanical limitations must be given proper consideration. While it is evident that the devices as now built can be depended upon, in general, to operate for years without special attention, it still is a mechanical device. It is, therefore, necessary to have well-qualified men to care for this equipment, both in the shop and in the field, to assure economical operation and customer satisfaction.

•

Shipments of Oil Burners Drop 58 Per Cent in Month

Domestic shipments of oil burners during November totaled 10,076 as against 24,228 in October and 16,083 in November, 1936, according to the Department of Commerce. For the eleven months' period, domestic shipments were 179,519 as against 181,376 in the corresponding period of 1936.

Stocks at the end of the month amounted to 24,559 as against 25,370 at the end of October and 15,174 at the end of November, 1937. Ignoring replacements, 179,519 oil burners would represent an annual energy consumption of about 40,500,000 kw.-hr. and revenue of approximately $8,100,000 a year.

Developing Load on Existing Rural Lines

[*Continued from page 40*]

bers of other appliances such as churns, washing machines, percolators, toasters, etc.

Engineering features

The engineering features of rural distribution lines are given constant study. In some instances it was found that the manufacturers of rural line equipment overemphasized economy. The result of the designs adopted by Alabama Power Company emphasizes reliability of operation as well as economy in construction. The basic feature of the rural line design is the development of the common neutral, single-phase line, the application of which to sparsely settled rural areas Alabama Power Company's engineers have been utilizing for years. Throughout, factors of safety within the National Safety Code requirements are maintained.

All poles are given suitable preservative treatment and all hardware is of galvanized material; aluminum and copper are the only classes of conductors used. Some of the poles are pine cut in the vicinity of the line and treated with preservatives recommended in the "Osmose" process. All other poles are given standard creosote or ZMA treatment. A substantial number of recently developed rural line type transformers have been installed and some recently perfected pole line hardware has been used.

•

Arkansas Plants Exchanged

Arkansas Utilities Commission has approved an exchange of power plants at Melbourne and Leslie, Ark., the exchange to bring about 24-hour electric service for customers in those two towns and electric rate reductions at Melbourne and Marshall. H. W. Wright, owner of the Melbourne plant, previously had applied for permission to exchange with the Arkansas Power & Light Company his plant at Melbourne for the utility's plant at Leslie.

Both Leslie and Marshall have been receiving electric service only eighteen hours daily. Frank Wilkes, general manager of the Arkansas Power & Light Company, said his company would authorize a rate reduction at Melbourne soon.

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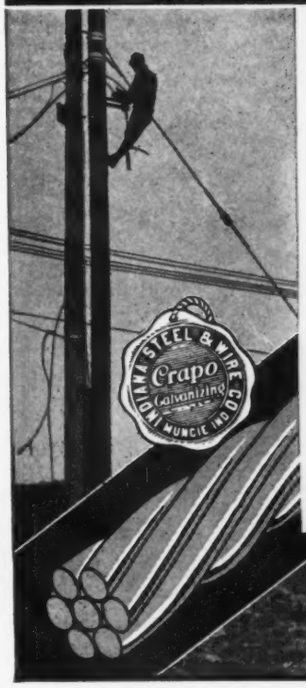

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Arc Rectifiers Succeed in Chlorine Production

[*Continued from page 36*]

gases and so arranged that these gases cannot get into the bus section. This section of the d.c. switchgear is insulated and designed for 1,000-volt d.c. operation at some future date.

The d.c. switchgear on the latest unit is made up of one two-pole, 8,000-amp. semi-high-speed, 3½-cycle air circuit breaker, totally inclosed, of the rigid type without the roll-out feature. This breaker is a combination cathode breaker for two rectifier tanks and a cell feeder. There is a direct-acting instantaneous reverse power trip on the positive pole and a time-delay, direct-acting overload trip on both poles.

In order to make speed requirements the positive pole trips free from the negative pole on operation of the reverse power device, tripping the negative pole after it has completed its opening stroke.

The rectifier cathode and transformer neutrals from each unit are brought to the breaker as separate circuits and are paralleled through four isolating switches to the lower side of the breaker. With both rectifiers operating as a unit a backfire will trip out both units.

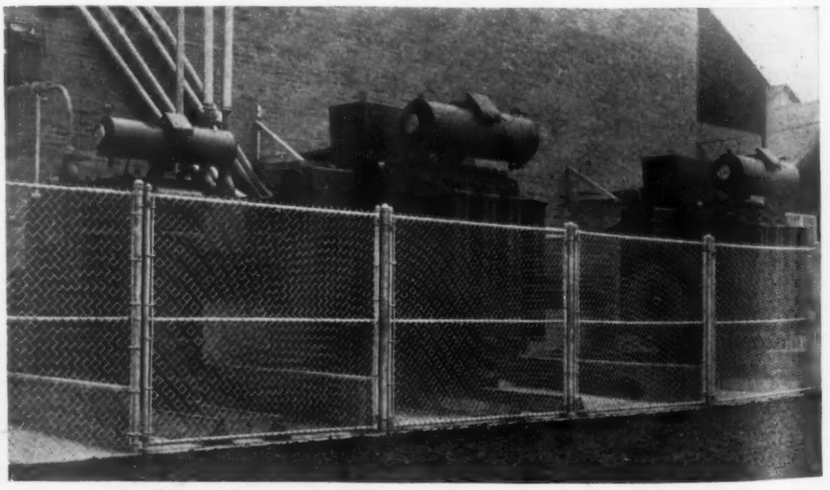
Grid control of voltage

Grids in the arc stream are the means of regulating the d.c. voltage down to 60 per cent of full voltage. These grids are connected to a six-phase transformer whose neutral is connected to the adjustable point of a potentiometer connected rheostat. The outer ends of the rheostat are connected across the d.c. terminals of the rectifier. This serves as d.c. bias and regulates the voltage. The grids lag the anode in whose arc stream they are located by 30 deg.

The chlorine cell has a decomposition voltage of approximately 66 per cent of the full production voltage. Zero load can readily be obtained by reducing the voltage to decomposition voltage or lower by grid control. This same control is operative from the power house and in case of an emergency it is possible to reduce the load any desired amount. The chlorine cell has an aging curve which is quite slow, requiring increasing voltage as the cells get older. To follow this curve, taps are changed on the transformer primary to the nearest point and very little grid control is used. Rectifier efficiency is affected by grid control and its use is discouraged. Transmission losses increase with its use and backfires occur more frequently.

Some difficulties have been experienced with grid control where the supply is taken from the same feeder supplying the rectifier. The distorted wave shape caused unbalanced load distribution between the units. To remedy this condition filters were connected in the grid transformer supply circuit.

With the recently installed rectifiers we have used a new method of degassing which will materially reduce the time necessary to form. This should cut down on the out-



Chlorine-caustic plant transformers are placed outdoors

Here are the rectifier and control transformers (Allis-Chalmers) for two of the rectifiers. Each set is rated 2,000/2,800 kw., 500/1,000 volts d.c.

age time chargeable to the rectifiers as the forming or degassing time is included in all outage time.

The rectifiers installed in our plant were manufactured by the Allis-Chalmers Company, the direct-current switchgear by the I.T.E. Circuit Breaker Company and the a.c. switchgear by the General Electric Company.

Willkie Proposal Strips Camouflage

[*Continued from page 46*]

was an unconditional surrender. And, by that token, it started folks who had not been interested wondering whether the processes which had forced that surrender were fair.

But consider the dilemma of the Administration! To accept the Willkie offer is to admit that government action is and has been frightening investors from putting their money into utilities. That fastens the blame squarely on the government for the failure of the utilities to spend that billion dollars a year additional for the last three years which Roosevelt and the Securities Commission and the Power Commission think they should have spent.

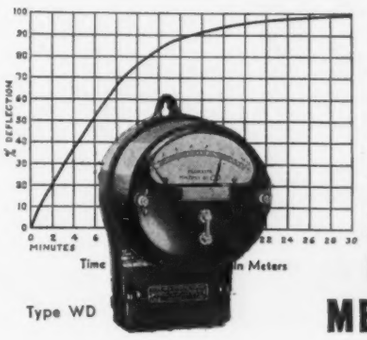
Further, it would make rather silly the Roosevelt contention that the operating companies are all right, but the wicked holding companies prevented them from making these expenditures just in order to retard prosperity, and then force Congress to repeal the public utility holding company death sentence.

But to reject the Willkie offer is to make the actual picture worse by frightening investors worse than ever from any thought of buying utility securities.

So—take it or leave it—the net result is to convince a lot of voters that the government *just may be* responsible for the recession after all.

And how the thing is being kept alive. Senator K. D. McKellar of Tennessee lets it be known that he does not like it. Whereupon Gov. Gordon Browning, who, incidentally, was *not* McKellar's choice for governor two years ago, comes out strongly for it. In fact, Browning wants Tennessee to join it! So maybe the next senatorial primary in Tennessee will be just as embarrassing to the Administration as the original Willkie proposal!

LINCOLN DEMAND METERS



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The above curve shows the time required to reach any percent of a steady load maintained for any given length of time. This time lag is inherent in the construction of Lincoln Meters and is due to the heat storage capacity of the material used.

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Save $75 Monthly by Raising Power Factor

[*Continued from page 37*]

Table II shows that the consumer could save approximately $75 a month by raising his power factor from 70 to 95 per cent. This monthly saving compounded semi-annually at 3 per cent for ten years will amount to about $10,500. Assuming complete amortization in ten years and allowing for interest on the investment also at 3 per cent, the above monthly saving will justify an expenditure for equipment of around $8,000.

The cost and installation charges for the power-factor correcting and regulating equipment finally installed was:

150-hp., 220-volt 80 per cent power-factor synchronous motor (Crocker-Wheeler)	$1,610
150-hp., 220-volt reduced voltage starter (Electric Controller & Manufacturing Company type)	1,050
Combined field panel and power-factor regulator (Electric Controller & Manufacturing Company type)	1,000
Installation materials	80
Handling and installing	230
Total cost of apparatus	$3,970

As there was nothing to be gained by operating the plant at a leading power factor the upper limit of the power-factor regulator was set at unity and to prevent unnecessary operation due to small variations of power factor the lower limit was set at 90 or 92 per cent power factor.

Table III presents a summary of weekly power readings and demand charges for the four weeks preceding the installation of the equipment and for the first four weeks of operation after the equipment had been installed.

•

Moves Unit to Baltimore

Westinghouse Electric & Manufacturing Company, through Walter C. Evans, manager of its radio division at Chicopee Falls, Mass., has announced that the entire radio division, including the broadcasting department, will be removed to Baltimore, Md. The company has purchased a modern manufacturing plant on the main highway to Washington, approximately 4 miles from the center of the Baltimore business district.

Plans have been made for the erection of a modern office building adjacent. Construction work will begin at once and it is expected that the transfer of the employees and equipment will be completed within the next six months.

Table II—Analysis of Twelve Monthly Power Bills

Month	Kw.-Hr. Charge	Demand	Demand Charge	Monthly Savings if P. F. Raised to 90%	95%	100%
July	620.08	357	407.00	59	75	89
August	607.12	339	389.00	56	71	85
September	801.52	365	415.00	61	77	91
October	719.44	360	410.00	59	75	90
November	786.40	385	435.00	64	81	97
December	934.36	412	462.00	67	85	102
December	702.16	421	471.00	70	88	105
January	790.72	430	480.00	71	90	108
March	931.12	388	438.00	65	82	97
April	752.92	387	437.00	64	81	97
May	751.84	358	408.00	60	76	90
June	907.36	364	414.00	60	76	91

Weekly Power Readings and Demand Charges Reduced to Weekly Basis

Date	Kw.-Hr.	Demand	R.-Kva.	Aver. P. F.	Max. Kva.	Billing Demand	Weekly Saving on Demand	
7/22	157.2	346	183.6	0.750	462	346	0	
7/29	152.4	339	177.6	0.652	520	339	0	Before
8/5	151.2	329	175.2	0.653	500	328	0	
8/12	156.0	357	164.4	0.688	520	357	0	
8/19	157.2	357	57.6	0.938	380	266	$17.75	
8/26	170.4	363	51.6	0.956	380	285	19.50	
9/2	165.6	375	57.6	0.948	396	297	19.50	After
9/9	139.2	375	50.4	0.940	399	300	18.75	

Too Much Diversity in System Fuse Links

[*Continued from page 34*]

0.1 second to the current which will melt the element in five minutes. This ratio varies with fuses which are now in use from about two to one for the very fast fuses to about twenty to one for the very slow fuses. However, this wide difference is not usually found on fuse links of any one size, but varies somewhat with the change in size, so the problem is not so formidable as it first seems. The general tendency is for the curves of the smaller sizes to be steeper than curves of the larger sizes. This natural condition is recognized in the standard for indoor fuses, which specifies the maximum melting time with 150 per cent load to be one minute for a 1 ampere fuse and fifteen minutes for a 600 ampere fuse, and is illustrated in Figs. 7 and 8. Fig. 7 shows 1, 10 and 100 ampere fuse links designed to open the same percentage of overload at the 0.1 second time value.

Space and strength limitations

Space limitations prevent the use of a large enough fuse body for the 100 ampere size to give the same rate of heat generation and heat radiation as for the 10 ampere, so the temperature builds up more rapidly on the 100 and it opens 200 per cent load much quicker than the 10 ampere size. Strength limitations prevent the use of a small enough fuse body for the 1 ampere size to give the same heating effect as for the 10, so the heat is carried away much more rapidly and the fuse will not open 200 per cent load. In order to get all sizes to open the same percentage of overload at the five-minute time value it is necessary to use a smaller element for the 1 ampere size, shifting its curve to the left, and a larger element for the 100 ampere size, shifting its curve to the right. The result is as shown in Fig. 8, where all sizes open 200 per cent load at the five-minute time value, but the load at 0.1 second time value is 500 per cent for the 1 ampere size, 1,000 per cent for the 10 ampere size and, 2,000 per cent for the 100 ampere.

It is not at all necessary that all sizes have a constant relation between the current at five-minute

Announcing!

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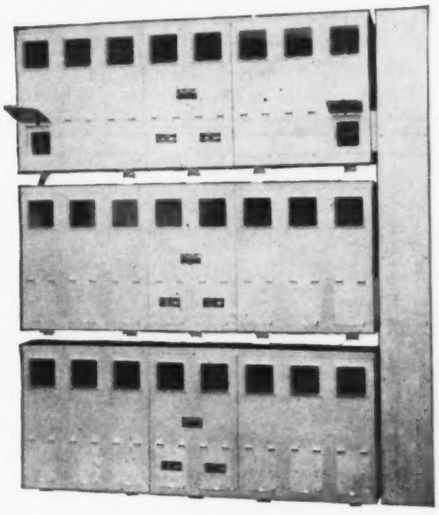

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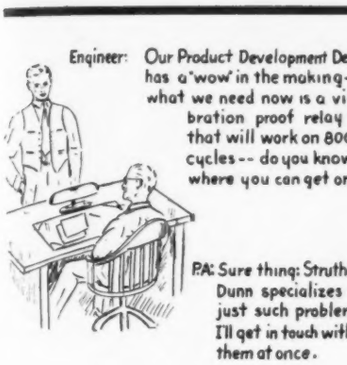
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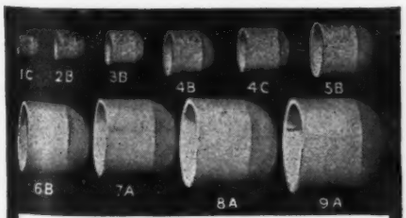

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time and at 0.1-second time. In fact, the variable relation has a very desirable feature as can be seen with reference to Fig. 9. Here there is an interval of 1,995 amperes between the 1 and 100 ampere sizes at the 0.1-second time value, which allows ample separation between adjacent intermediate sizes for purposes of selectivity. If the 100 ampere size were made to open the same percentage of load at 0.1 second as the 1 ampere size, 500 amperes, the interval between the 1 and the 100 would be only 495 amperes, which would give a much smaller interval between sizes, with resulting harm to selectivity.

Standardization desirable

It is, of course, possible to shift the curves by other means to a considerable extent, as has been described earlier, but since such methods are sometimes harmful to other important characteristics and since there is no real need for such practice it seems best to allow the curves to take their more natural shape.

It is thought that standardization of the line of fuses, as shown in Fig. 9, with reasonable tolerances such as could be observed by the various manufacturers, would do much to relieve the present confusion of fuses and result in a material benefit to the utilities and manufacturers alike. Even with the present wide array of fuse sizes and time-current curve shapes to choose from to fit a particular operating condition closely difficult fusing problems continually arise, but these problems do not seem to be so serious or so numerous as those which result from unexpected conflicts among that large array of sizes and shapes.

Which is to say that while it is nice to have a large diversity of sizes and curve shapes to choose from, that diversity itself is dangerous because it magnifies the chances of error in selection. With only one line of fuses to choose from, as has been suggested in this article, difficult problems of fuse application will still continue, but it is felt that the reduction in number of sizes and curve shapes and the consequent reduction in the chances of error in selection for a particular condition will more than compensate for restriction of choice.

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WANTED FOR THE Panama Canal. Electrical Designer, entrance salary $333.33 a month. Graduate electrical or mechanical engineer with at least three years' experience in design and supervision of design of electrical installations for offices, schools, industrial buildings, indoor and outdoor substations, and design of ventilating and refrigerating installations, hoisting and other mechanical equipment. Must be American citizen (final papers) under 45 years, in good health. Free steamship transportation from New York or New Orleans, salary beginning date of sailing. For further particulars write "Chief of Office, The Panama Canal, Washington, D. C."

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SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 28 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreements. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y. (Electrical World).

POSITIONS WANTED

UTILITY CORPORATIONS: Utility real estate and franchise taxation expert realty appraiser; right-of-way acquisition; remarkably successful tax saving record in utility property taxation; salaried connection desired. PW-727, Electrical World, 330 West 42nd Street, New York City.

ELECTRICAL INSTALLATION and Maintenance Engineer. 20 years' experience. At present installing power plant and plant distribution system in woolen mill in New England, will complete installation in April. Will supervise or install complete power and plant distribution systems; Qualified on turbine, diesel or water wheels installations and their control equipment, especially interested in paper mills and their problems but have general factory experience. Will go anywhere and will be very glad to furnish references from satisfied factory owners. PW-738, Electrical World, 330 West 42nd Street, New York City.

ESTIMATING AND CONSTRUCTING Engineer. Age 30 years. Experienced in high voltage transmission line, substation, power and building wiring. Wanted by an Ohio electrical constructing company of long standing. Please state complete experience, compensation desired, and enclose photograph. Strictly confidential. PW-739, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER—Manager or superintendent utility or industrial engineering sales. M.I.T. graduate. 12 years in public utilities on power sales, power generation and industrial engineering. Continuously employed. Has the sustained driving power that gets results. PW-740, Electrical World, 330 West 42nd Street, New York City.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

QUAL. ELECTR. Engineer, G.I.E.E., wants to represent as sole agent manufacturers in Great Britain. Offers to RA-737, Electrical World, 330 West 42nd Street, New York City.

OFFICIAL PROPOSAL

Bids: February 23

Watthour Meters

P. W. A. PROJECT DOCKET NO. TENN 1107-P-D
SUB-PROJECT—CONTRACT 24
MEMPHIS LIGHT AND WATER DIVISION
CITY OF MEMPHIS
MEMPHIS, TENNESSEE

Sealed proposals for the manufacture and delivery f. o. b. cars Memphis, Tennessee, of Watthour Meters for the Memphis Light and Water Division, City of Memphis, Memphis, Tennessee,

P. W. A. Project Docket No. Tenn. 1107-P-D
SUB-PROJECT—CONTRACT 24

will be received by the Board of Light and Water Commissioners, Memphis Light and Water Division, City of Memphis, Memphis, Tennessee, at the office of the Secretary of the Memphis Light and Water Division, Goodwyn Institute Building, Memphis, Tennessee, until 2:00 P. M. on Feb. 23, 1938, and will be immediately publicly opened and read by the Board of Light and Water Commissioners.

A charge or deposit of twenty ($20.00) dollars will be required of eligible bidders for procuring specifications and contract documents. The deposit for specifications will be returned to all except the successful bidder on the return of specifications and contract documents in good condition within ten (10) days after bids are opened.

A copy of the specifications and contract documents may be examined free of charge at the office of the Memphis Light and Water Division.

Each bid must be accompanied by a certified check or bidder's bond, executed by the bidder and a surety company licensed to do business in Tennessee, in the sum of (10%) per cent of the amount of the bid. The bond is required as a guarantee that if the bid is accepted, a contract will be immediately entered into and the performance of it properly secured. The successful bidder will be required to execute a performance bond acceptable to the Board of Light and Water Commissioners in the amount of one hundred (100%) per cent of the total contract price, and said performance bond, among other things, shall provide that the Contractor will pay for all labor and materials used by said Contractor, or any immediate or remote subcontractor under him, in said contracts, etc.

All items on the Bidding Blank and Data Sheets must be properly filled out and must not be detached from the specifications. No qualifying letters or statements will be considered.

Bidders shall also designate on the envelope containing the bid the project bid upon.

WITHDRAWAL OF BIDS: No bidder may withdraw a bid submitted for a period of thirty days after the date set for the opening of such bids.

The estimated cost of equipment on Contract 24 is $56,000.00.

The Board of Light and Water Commissioners reserves the right to reject any or all bids, and to waive informalities therein.

Any bid received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

MEMPHIS LIGHT AND WATER DIVISION,
City of Memphis, Memphis, Tennessee.
By THOS. H. ALLEN, Chairman,
W. W. MALLORY, Vice-Chairman,
I. J. LICHTERMAN, Commissioner,
Board of Light and Water Commissioners.
Attest: N. W. WADE, Secretary.

A. C. Motors
3 PH. 60 CY. SLIP RING

HP	Make	Volts	Speed
850	West.	2200	710
500	Al.Ch.	4000/2300	500
450	West.	2200	875/700
400	Al.Ch.	2300	505
400	West.	440	450
400	G.E.	2300/4150	390
300	Al.Ch.	2200	585
250	G.E.	2200	900
250	G.E.	4000/2300	257
250	F.Morse	2200	1200
250	West.	2200	500
250	West.	440/220	585
250	Cr. Wh.	440/220	435
225	G.E.	440/220	1800
200	West.	550/220	505
200	West.	440/220	580
150	G.E.	440/220	870
100	G.E.	440/220	514
100	G.E.	550/220	700

SYNCHRONOUS

1500	G.E.	440/220	180
1400	G.E.	4000/2300	514
1000	West.	2400	900
450	West.	440/220	257
375	G.E.	2300	600
350	Cr. Wh.	2300/440	720
300	G.E.	440/220	600
225	El. Mch.	2300/4150	450
200	West.	2200/550	1800

SQUIRREL CAGE

250	West.	2300/440	580
250	Al. Ch.	440/220	1200
200	G.E.	440/220	1760
150	G.E. IK	2300/550	900
125	G.E.	550	600
100	G.E.	440/220	720

Motor Generator Sets
3 PH., 60 CY. & 25 CY.

2000 KW Al.Ch. DC 275V interpole to Sy 12000/6600V 300 RPM 25 cy
2-1250/1500 KW West 3un 2-625/750 KW DC 125 V on ea end of 1-1930 KVA Sy 2200V 600 RPM with exciter. 60 cy
1000 KW GE MPC DC 600V to 1400 HP Sy ATI 4000V 514 RPM. 60 cy
1000 KW GE MPC DC 250V to 1400 HP SY 6600/2300V 514 RPM. 60 cy
500 KW GE MPC DC 250V Comp. interpole to 700 HP Sy ATI 2300V 720 RPM. 60 cy
3-300 KW GE MPC DC 600V to Sy ATI 2300V 720 RPM. 60 cy
2-250 KW GE DC 250V to Sy ATI 2300V 720 RPM. 60 cy
250 KW GE 3un 250/125V Sy 2-125 KW interpole DC Gen 125V on ea end of 1-390 HP Sy 6600V 750 RPM. 25 cy
200 KW Ridgeway DC 275V to 300 HP Sy 440/220V 900 RPM. 60 cy.
175 KW West DC 275V to 260 HP Sy 440/220V 1200 RPM. 60 cy
140 KW Cr.Wh. 125/250V 3un 2-70 KW CCD Comp. interpole DC 125V on ea end of 200HP Sq Cage 2300V 690 RPM. 60 cy

Transformers—60 Cy. Ph.

2-4000 G.E. WCT, 79600x2300		3
3-333 Mal'y, 13200x6600/2200		1
3-300 G.E.H 2400x120/240		1
3-200 West.SK 2300x460/230-115		1
3-100 Pittsburgh 2300x115/230		1
2-75 Mal'y HE 2200x110/220		1

D. C. Motors
ADJ. SPEED—230 V

HP	Make	Type	Speed
875	West		480/720
550	West		240/720
500	G.E.	MPC	180/350
400	G.E.	MPC	160/300
400	West.	QS	450/675
300	West.	SK	150/300
200	G.E.	DMC	300/600
125	West.	SK-210	225/900
125	G.E.	DMC	150/300
120	G.E.	DMC	300/750
100	West.	SK	475/1000
100	Reliance	1050T	400/1200
80	Diehl	K11-40	550/1100
75	Cr. Wh.	100H	300/900
60	El. Dy.	25-S	525/1050
50	West.	SK-190	225/600
40	Cr. Wh.	H	175/700
35	West.	SK	500/1500
30	Rel.	T-262T	500/1500
25	West.	SK-130	375/1200
20	G.E.	LC	650/1950

CONSTANT SPEED

400	West.	QS	450
400	G.E.	MPC	500
200	G.E.	DMC	475
200	West. El.	MPC	1750
100	G.E.	C.D.	850
100	G.E.	R.C.	600
100	Cr. Wh.	100H	600
100	G.E.	C.D.	850
100	G.E.	R.C.	950
75	G.E.	C.D.	575

A. C. Gen. 3 Ph-60 Cy.

KVA	Make	Volts	Speed
1250	G.E.	440/220	180
1000	West.	2300	900
937	Al. Ch.	2300	450
750	West.	480	3600
375	West.	2300	240
300	G.E.	480/240	600

RE-NU-BILT BELYEA MOTORS

ABOVE IS ONLY A PARTIAL LISTING
WE ALSO SPECIALIZE IN GENERATORS, GEAR REDUCERS
ROTARY CONVERTERS, GAS ENGINE GENERATOR SETS & PUMPS

BELYEA CO., Inc.
151 West 18th St.
New York, N. Y.

MOTOR GENERATOR SET

150 KW, General Electric, 3 bearing unit, 2300 volts AC, 3 phase, 60 cycle, 80% PF. direct connected to DC Generator; all control equipment in excellent condition.

DENNY & CLARK
910 N. Marshfield Ave. Chicago, Ill.

FOR SALE

150 H.P. vertical, 3 cylinder Rathbun-Ingersoll-Rand, 4 cycle, solid injection full **Diesel Engine, direct connected to 125 K.V.A. General Electric Generator**, 3 phase, 60 cycle, 480 volt (can be reconnected for 240 volt) used very little—excellent condition—For Immediate Sale—Write or wire.

STEPHEN HALL & CO.
7th and Adams Sts., Hoboken, N. J.

FOR SALE—Immediate Shipment

1—Practically New **GENERAL ELECTRIC** 150 KW **Frequency Changer**; Direct connected through flexible coupling to a 75 HP 1200 RPM driving motor both mounted upon a common sub-base for a main line current of AC, 60 cycle, 3 phase, 220 volts; to give a secondary of 375 volts for 100 cycles for 6000 RPM spindle speed. Complete with all the necessary electrical control equipment. This is a complete Frequency Changer Unit. *We offer at bargain price.*

EARLE HART WOODWORKING MACHINE CO.
565 W. Washington Blvd. CHICAGO, Ill.

WANTED

WANTED

1—200 HP 600 or 720 RPM 60 Cycle **SYNCHRONOUS MOTOR WITH EXCITER**
1—125 or 150 HP 428 RPM 50 Cycle **SYNCHRONOUS MOTOR WITH EXCITER**
Both 3 PH. 440 V. .8 PF
Also Starting Equipment for Above
Address PO Box 29, Mishawaka, Ind.

New "SEARCHLIGHT" Advertisements

must be received by **10 A. M. Monday** to appear in Saturday's issue.

Address copy to the Departmental Advertising Staff
Electrical World
330 West 42nd St., New York City